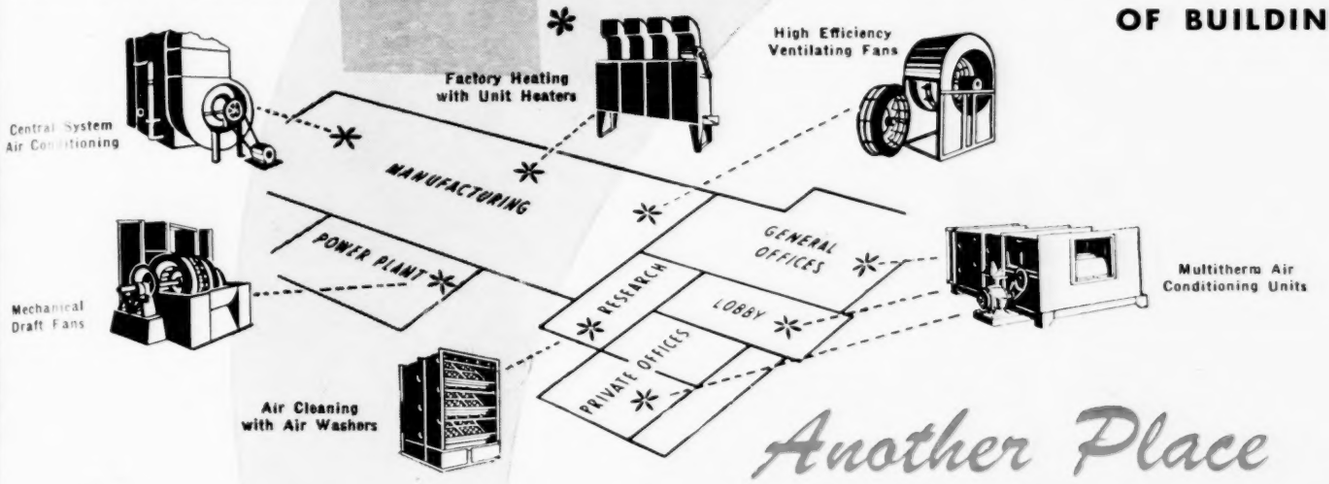
THERE'S CLARAGE EQUIPMENT FOR EVERY NEED IN EVERY TYPE OF BUILDING



Another Place

CLARAGE

Saves You Money

IS IN

FACTORY HEATING

NOT as much fuel required with Clarage Unitherm Unit Heaters . . . the reason, SYNCROTHERM CONTROL.

Here's a patented device, obtainable ONLY on Clarage Unitherms, which controls temperatures by regulating the amounts of return air passing through and/or around the heating coil.

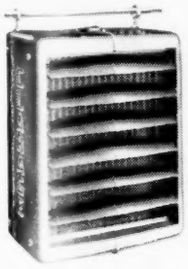
A constant circulation of heated air is maintained — *no stratification; no hot ceilings; no cold floors.*

And since uniform, effective heating is accomplished with LOWER temperature air, *operating economies are substantial.*

If you have any type of industrial heating problem, Clarage Unitherm Unit heaters — and SYNCROTHERM CONTROL — merit your investigation.

Unitherms are also built in the SUSPENDED TYPE— to save floor space — installed either along the walls or at the ceiling.

UNITHERM HEATER FLOOR TYPE



CLARCO HEATERS

Unitherm Unit Heaters

also have other highly desirable features. Note V-belt drive insuring quieter operation, wide flexibility of output. Note that outlets are square, permitting 4-way adjustment of heat flow. What you can't see are the positive, centrifugal fans which spread heat evenly over wide areas; that every working part is easily accessible by removing either front or back of casing.

CLARCO HEATERS are for smaller heating jobs, and to "help out" present equipment. Both Unitherm and Clarco Heaters are available in a wide range of sizes, operating either on steam or hot water.

CLARAGE FAN COMPANY

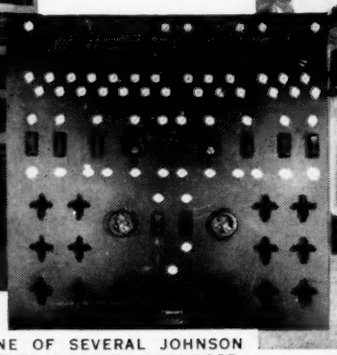
KALAMAZOO, MICHIGAN . . . SALES APPLICATION OFFICES IN ALL PRINCIPAL CITIES

Widely Publicized

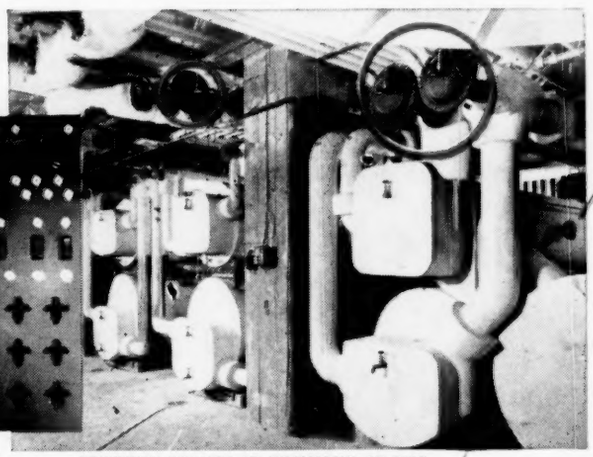
"HEAT PUMP" INSTALLATION

CONTROLLED BY JOHNSON

THE EQUITABLE BUILDING, PORTLAND, ORE. • ENGINEER: J. DONALD KROEKER ARCHITECT: PIETRO BELLUSCHI • CONTRACTOR: P. S. LORD • TRANE AIR CONDITIONING EQUIPMENT USED THROUGHOUT.



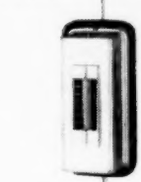
ONE OF SEVERAL JOHNSON CONTROL PANELS WHICH PERMIT THE OPERATION OF THE SYSTEM TO BE OBSERVED FROM CENTRAL LOCATIONS.



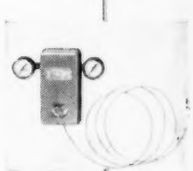
JOHNSON VALVES IN COMMAND AT THE TRANE TURBO-VACUUM COMPRESSORS.

ENGINEERS everywhere are talking about it . . . the Equitable Building in Portland. Praises and congratulations are being heaped upon the engineer, architect and contractor whose cooperative efforts resulted in this great monument to progress and these remarkable achievements. Most important, perhaps, is the fact that this is the world's largest "HEAT PUMP" installation. Year-'round air-conditioning demands—usual or unusual—present no problems . . . All are controlled with precision. The whole system is the result of perfect planning . . . and this "reverse cycle" system is completely automatic. There are no definite transition points between the various cycles of operation: (1) when the demand for heating is greater than that for cooling; (2) when the need for cooling exceeds that for heating; (3) when there is a demand for cooling only. The unique control features of this interesting air-conditioning system are made possible by the superior control characteristics of the highly accurate "T-900 Series" of Johnson thermostats . . . Johnson engineers are prepared to cooperate in solving all types of temperature and air-conditioning CONTROL problems. JOHNSON SERVICE COMPANY, MILWAUKEE 2, WISCONSIN AND DIRECT BRANCHES IN PRINCIPAL CITIES.

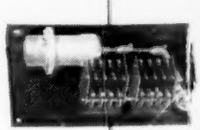
FEATURES OF JOHNSON CONTROL IN THE EQUITABLE BUILDING



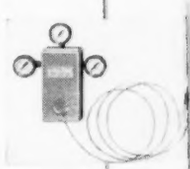
1. The building is divided into heating and cooling zones. (Most of the floors are arranged to provide 11 zones.) Each zone is controlled separately by a Johnson room thermostat.



2. Johnson T-900 outdoor master thermostats measure the external heating and cooling requirements and limit the amount of refrigeration capacity which can be brought into operation at less than design load. This reduces the electric power demand charges to the lowest possible minimum.



3. The refrigeration capacity is controlled by a Johnson pneumatic step-controller, operated from Johnson thermostats which measure the heating and cooling demand. The number of refrigerating compressors in operation, at any time, is determined by whichever demand (heating or cooling) is greater.



4. Water temperatures are varied continually, for heating and cooling. Automatic control is accomplished by Johnson T-901 sub-master thermostats commanded by a Johnson T-900 master thermostat which measures outdoor temperature.

JOHNSON *Automatic Temperature and Air Conditioning* CONTROL

DESIGN · MANUFACTURE · INSTALLATION · SINCE 1885

TECHNOLOGY DEPARTMENT

NOVEMBER, 1948

HEATING AND VENTILATING

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DETROIT

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION

Joints for Wood and Fiber Pipe Page 85

Bamboo pipe lines serve 2,000-year-old salt mine at Tse Liu Ching, China.

Heating Greenhouses with Unit Heaters . . page 57

Use of Gas for Heating Large Buildings . page 67

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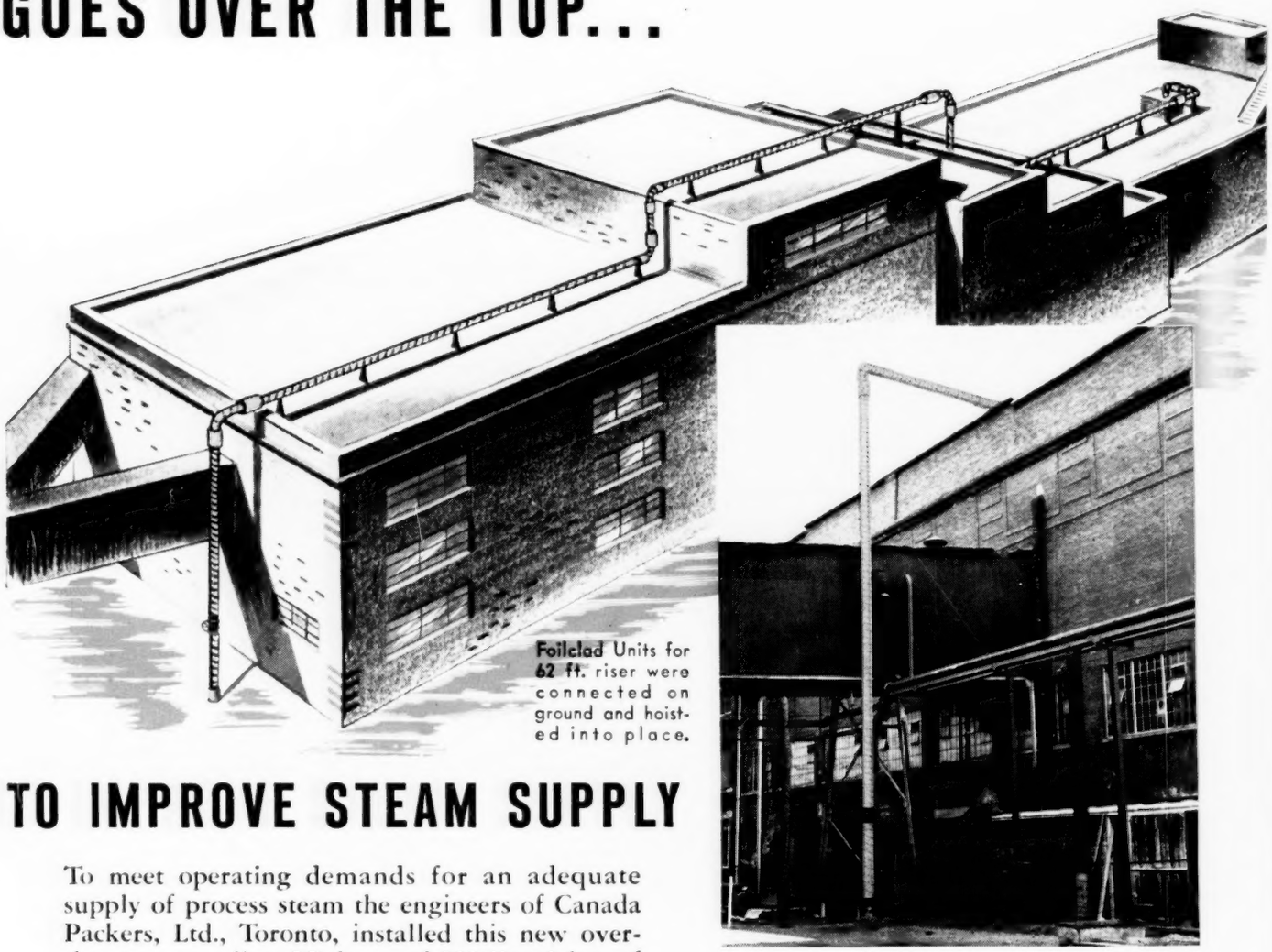
Corrosion of Metals . page 64

THIS RIC-WIL *Copperclad* LINE GOES OVER THE TOP...



Foilclad Units for **62 ft.** riser were connected on ground and hoisted into place.

TO IMPROVE STEAM SUPPLY

To meet operating demands for an adequate supply of process steam the engineers of Canada Packers, Ltd., Toronto, installed this new over-the-top steam line. Made up of 550 lineal feet of 8 inch pipe, it is designed to carry 80,000 pounds of steam per hour at 150 psi, 366° F.

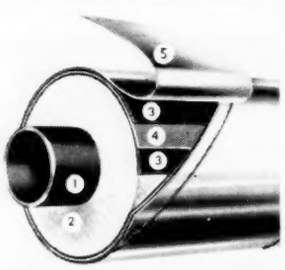
The line connects to a supply system running underground and rises vertically to form a huge expansion loop supported on the roof. Desired flexibility is obtained by shaping the structure to conform with roof contour and changes of roof elevation. The vertical pipe tangents absorb horizontal movement of the line due to expansion, while horizontal tangents perform a similar function with respect to vertical movement.

As specified, Ric-wiL pre-fabricated, pre-insulated Copperclad Piping was furnished in 21 foot tangents and elbow units, minimizing field erection costs. Ric-wiL sub-assemblies were scientifically designed to allow for pipe expansion and contraction, thus adding to the flexural properties of the system.

The Ric-wiL Copperclad Piping employed in this installation combines pipe, insulation, high temperature asphalt and spiral wrappings of asbestos felt and copper sheeting into thermally efficient units which are corrosion resistant and fully protected against the elements. This Ric-wiL construction is positive assurance of outstanding durability and long life with minimum upkeep and maintenance cost.

FOILCLAD CONSTRUCTION

1. Pipe as specified
2. Insulation
3. Double Coating of High-Temperature Asphalt
4. Asbestos Felt, Tension Wrapped
5. Copper or Aluminum Foil; Tension Wrapped



See Our Exhibit . . . Booths 48-49

NATIONAL POWER SHOW — NEW YORK — NOV. 29-DEC. 4

RIC-WIL

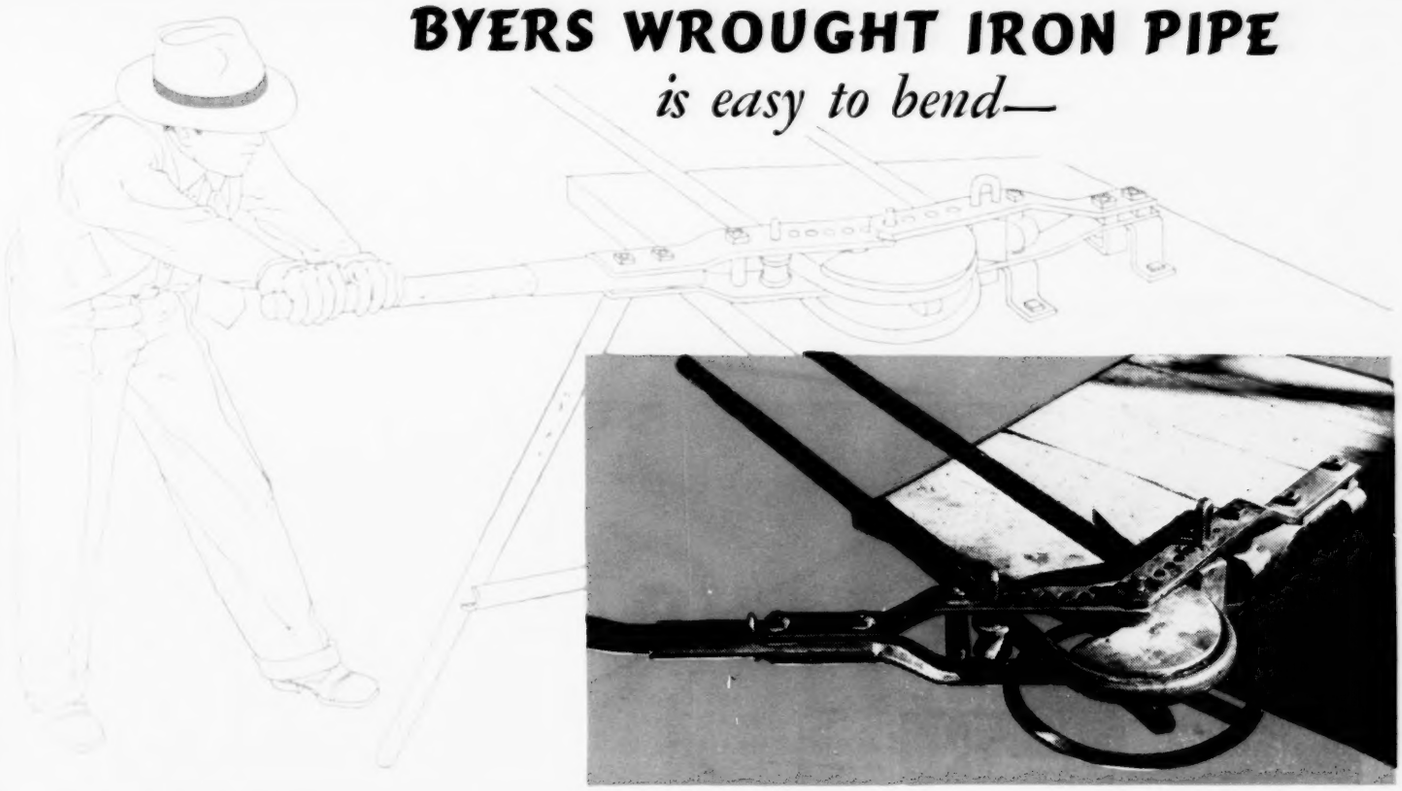
INSULATED PIPING SYSTEMS

THE RIC-WIL COMPANY • CLEVELAND, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

BYERS WROUGHT IRON PIPE

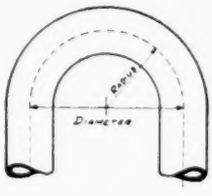
is easy to bend—



If you are installing continuous coils in a radiant heating system, or are required to bend pipe in connection with any type of system, you'll find that wrought iron —in addition to its corrosion resistance, fatigue resistance and weldability—has *ductility* that permits close bends to be readily made cold, with simple equipment.

Minimum Radii of Cold Bends

Some degree of flattening permitted



Size of Pipe	Minimum Radius of Bend Standard Weight	Extra Strong
3/8"	1.10"	1.10"
1/2"	1.40"	1.40"
3/4"	1.75"	1.75"
1"	2.15"	2.15"
1 1/4"	2.75"	2.75"
1 1/2"	3.50"	3.10"
2"	5.50"	4.60"

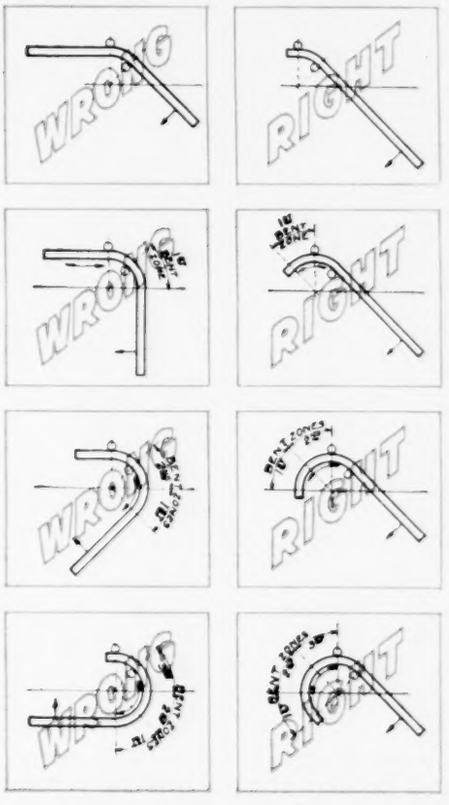
The minimum bend radii recommended for various sizes of Byers Wrought Iron pipe, both standard weight and extra strong, are shown in the table.

In bending wrought iron pipe, three fundamental requirements should be observed. (1) The force should be applied as a slow, steady pressure—to permit the material to flow. (2) The bending stress should be applied successively to short sections of the pipe. And, (3) the bent or stretched portion should be advanced *out* of the bending zone, so as not to be subjected to further stress. The small diagrams at right illustrate the wrong and correct methods.

For large-radius bends the conventional pipe bending tables, employing pins, are satisfactory. For the production of close radii bends, however, it is desirable to employ some form of mechanical pipe bending device. In several instances, customers have used "homemade" equipment with good results, but a number of makes and models of inexpensive pipe benders for field and shop use are available, and generally prove a good investment.

Our bulletin, "The Bending and Flanging of Wrought Iron Pipe" discusses both the principles and practice of cold and hot pipe bending. If you would like a copy for your file, or to pass on to your workmen, we will be glad to supply you.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N. Y.



Here original bent sections are stressed when successive bends are made.

Here bent sections advance out of bending zone, are not subjected to further stress.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Greenhouse Heating with Steam

Tropic Gardens Greenhouse, Quakertown, Pa., showing application of Webster-Nesbitt Unit Heaters together with use of pipe coils under greenhouse beds with Webster Metering Orifice fixture applied to pipe coils. Heating Contractor: Louis Roth & Company, Philadelphia.

For more than 30 years, Webster Heating Equipment has had a place in greenhouse heating.

Webster equipment, properly applied, has met greenhouse heating requirements. Webster Service provided by trained, long-service representatives has helped greenhouse operators solve their unusual heating problems.

In a unique installation in Tropic Gardens Greenhouse, Quakertown, Pa., Webster-Nesbitt Unit Heaters supplement pipe coils under greenhouse beds, equipped with Webster Manifold Coil Orifice Fittings, to provide desired results.

Among the interesting operating features is the night operation of Webster-Nesbitt Unit Heaters during snowfall, leaving the glass free of snow during the day and avoiding a snow removal operation.

In many other greenhouse installations Webster Series "26" Float-and-Thermostatic Traps have proved invaluable by providing immediate one hundred per cent drainage of condensation from long pipe coils.

Other Greenhouses Equipped with Webster Systems of Steam Heating

Batavia Greenhouse—Batavia, Ill.
Bourdet Floral Company
St. Louis, Mo.
Candler Greenhouse—Atlanta, Ga.
Chevalley, Julius, Greenhouse
Bayport, Long Island, N. Y.
Davies, M. L. Greenhouse,
Bellevue, Wash.
Davis Aurora Company—Aurora, Ill.
Florex Gardens—North Wales, Pa.
Hafer Brothers Greenhouse
Indianapolis, Ind.
Hill, The E. G. Company
Richmond, Ind.
Hill, Joseph H. Company
Richmond, Ind.
Hollywood Gardens, Seattle, Wash.
Jewel Box—Forest Park, St. Louis, Mo.
Kenninger Bros. Greenhouse
Indianapolis, Ind.
Kernel-Sochar Greenhouse
Indianapolis, Ind.
Missouri Botanical Gardens
Grays Summit, Mo.
Niemeyer Greenhouse
Indianapolis, Ind.
Primier Rose Gardens
Desplaines, Ill.
Ristow, Charles, Greenhouse
Indianapolis, Ind.
Ristow, Walter, Greenhouse
Indianapolis, Ind.
Saxe Floral Gardens, Seattle, Wash.
Schroeder Greenhouse
Indianapolis, Ind.
Wellsworth Farm Greenhouse
Downers Grove, Ill.

Your nearest Webster Representative is a trained heating man. Write us about your problem. We will pass it on to him and he will be glad to work on it with you.

Address Dept. HV-11

WARREN WEBSTER & CO., Camden, N. J.
Representatives in principal U. S. Cities :: Est. 1888
In Canada, Darling Brothers, Limited, Montreal

Webster
HEATING SYSTEMS

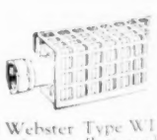
Some Items of Webster Heating Equipment Serving Greenhouses

Webster Manifold Coil Orifice Fitting balances steam distribution in pipe coil installations, resulting in partial heating throughout entire length.

Webster EH-10 Moderator Control Cabinet and Outdoor Thermostat provides automatic heat variation for small and medium size buildings of 1500 to 5000 sq. ft. EDR.

Webster Float and Thermostatic Drip Traps are used on heating coils of air conditioners and drip points of the piping system.

Webster Thermostatic Radiator Trap—the world's best known radiator trap.



New! Webster Type WI Radiation for installation where floor or wall space is limited.

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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Editor
CLIFFORD STROCK

Associate Editors
NATHAN N. WOLPERT
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Advertising Staff

Western Representative
GEORGE G. TURNER
228 North La Salle Street
Chicago 1, Ill.

Eastern Representative
HARRY J. TWINE
148 Lafayette Street
New York 13, N. Y.

Pacific Coast Representative
ROBERT H. DEIBLER
2506 W. 8th Street
Los Angeles 5, Calif.

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President
ROBERT B. LUCHARS

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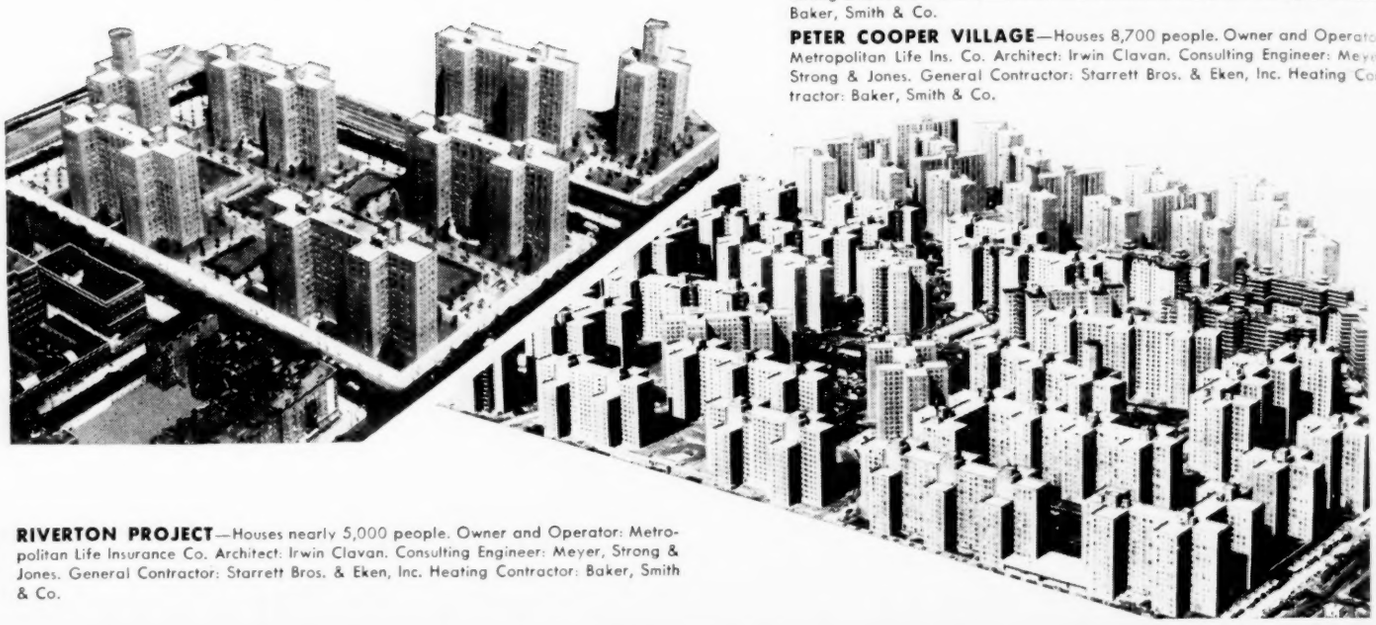
PUBLISHERS OF MACHINERY & MACHINERY'S HANDBOOK
The INDUSTRIAL PRESS

THIS MONTH'S COVER

At the ancient salt mines of Tse Liu Ching, China, 300,000 laborers produce 250,000 tons of salt a year. Huge bamboo pipe lines connect refineries and salt wells. Acme photo.



STUYVESANT TOWN—Houses 24,000 people. Owner and Operator: Metropolitan Life Ins. Co. Architect: Irwin Clavan. Consulting Engineer: Meyer, Strong & Jones. General Contractor: Starrett Bros. & Eken, Inc. Heating Contractor: Baker, Smith & Co.

PETER COOPER VILLAGE—Houses 8,700 people. Owner and Operator: Metropolitan Life Ins. Co. Architect: Irwin Clavan. Consulting Engineer: Meyer, Strong & Jones. General Contractor: Starrett Bros. & Eken, Inc. Heating Contractor: Baker, Smith & Co.

RIVERTON PROJECT—Houses nearly 5,000 people. Owner and Operator: Metropolitan Life Insurance Co. Architect: Irwin Clavan. Consulting Engineer: Meyer, Strong & Jones. General Contractor: Starrett Bros. & Eken, Inc. Heating Contractor: Baker, Smith & Co.

HERE'S PROOF THAT DUNHAM "Vari-Vac" Differential HEATS

FRESH MEADOWS—Houses 10,000 people. Owner and Operator: New York Life Insurance Co. Architect: Voorhees, Walker, Foley & Smith. Consulting Engineer: Meyer, Strong & Jones. General Contractor: George A. Fuller Co. Heating Contractor: J. L. Murphy, Inc.

CLINTON HILL—Houses 10,000 people. Owner and Operator: Equitable Life Assurance Soc. of the U. S. Architect: Harrison, Fouilhoux & Abramovitz. Consulting Engineer: Edw. E. Ashley. General Contractor: Starrett Bros. & Eken, Inc. Heating Contractor: Baker, Smith & Co.

"VARI-VAC" IS JOB-SCALED FOR BUILDINGS OF EVERY SIZE

You can specify the exclusive advantages of this more comfortable, more economical system for any buildings you design. There is a Dunham "Vari-Vac" Differential System for every installation and budget from the largest to the reasonably modest. Write for details of a system tailormade to meet your requirements, there are seven applications of "Vari-Vac"—basic, primary, medium, intermediate, advanced, de luxe, supreme.

OGONTZ MANOR—Houses 600 people. Owner and Operator: Ogontz Housing Corp. Architect: George S. Idell. Consulting Engineer: Johnson, New York City. General Contractor: Anthony P. Miller. Heating Contractor: Anthony P. Miller.

PARKCHESTER—Houses 42,000 people. Owner and Operator: Metropolitan Life Insurance Co. Architect: R. H. Shreve, Chief architect; Irwin Clavan, Assoc. Consulting Engineer: Henry C. Meyer, Jr. General Contractor: Starrett Bros. & Eken, Inc. Heating Contractor: Baker, Smith & Co.

PARKWAY VILLAGE Houses 2,000 people. Owner and Operator: Parkway Village, Inc. Architect: Leonard Schultze & Associates. Consulting Engineer: Albert Fentzlaff, Inc. General Contractor: George A. Fuller Co. Heating Contractor: Baker, Smith & Co.

ENTIRE CITIES with populations ranging from 3500 to 45,000

Why Did These Insurance Companies Make Investment in the "Vari-Vac" Differential Heating System?

Because it gives:

Accurate temperature control meeting exactly all changing weather conditions.

Unsurpassed Comfort—even heating.

Unmatched Fuel Savings—changed over installations have shown 40% or more fuel or steam saved.

*Reduced Operating and Maintenance Costs

*The owners enjoy a money-saving operation because the simplified Dunham "Metro Method of Piping" greatly reduced installation and operating costs. Literally a "one pipe system" with all the benefits of subatmospheric steam—no radiator branches, no expansion joints, an irreducible minimum of pipe and fittings.

Tenant Satisfaction Increased. Full Occupancy Maintained

The differing heat needs of so wide a variety of people and of occupancy are met by the exclusive ability of Dunham to meet the heat requirements in a building or group of buildings regardless of rapidly changing weather or occupancy conditions.

Architects—Engineers—Contractors—Building Owners and Managers agree that Dunham "Vari-Vac" Differential Heating provides greatest comfort at lowest cost.

Wasteful Steam Heating Systems Can Be Changed Over to Differential Operation

The modernizing work can be done by your own heating contractor with a minimum of expenditure and inconvenience to you. Existing boilers, piping and radiation can usually be used, but the method of steam distribution and control is altered to make the original installation operate more efficiently and more economically.

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400 West Madison Street • Chicago 6, Illinois

Toronto, Canada • London, England

DUNHAM

HEATING MEANS BETTER HEATING

IT'S EXCLUSIVELY IN

THRUSH Water Circulators

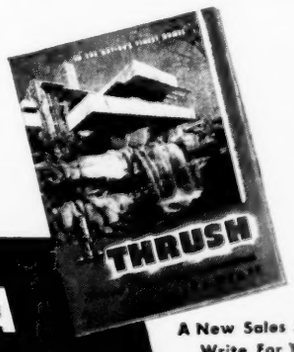
FOR LIFETIME SERVICE

Patented Pumping Arrangement Keeps Oil Flowing Constantly Through Bearing
Large Reservoir of Oil Sealed in Bracket
Cushioned Oil Seal
Micro-finish Lapped Seal
Water Seal

DOUBLE OIL AND WATER SEAL

Improved Oiling SYSTEM SEALED IN...

IT'S BETTER! Twenty years of Circulator manufacturing experience is evidenced in this advanced design. Undue wear and servicing is eliminated by the patented built-in oil lubrication system. This large oil reservoir in the Circulator bracket provides positive lubrication without attention. No more grease cups to fill. Double oil and water seals have been proved by exhaustive tests. Cushioned seals rotate against special metal assuring leak proof operation for years. Occasional lubrication of motor bearings is all that is required. Build a reputation for fine heating and increase your sales by recommending Thrush equipment on every Hot Water installation. Ask your wholesaler about it today or write Dept. D-11.



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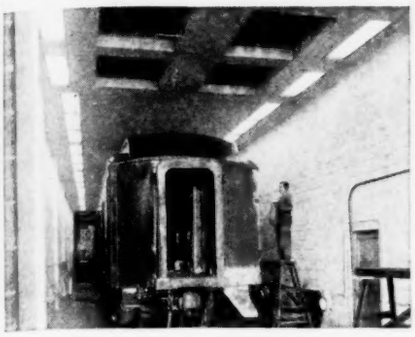


Paint Shop at Central Railroad of New Jersey at Elizabethport, N. J.

Ventilation of a Railroad Paint Shop

The importance of proper ventilation in paint-spray operations cannot be overemphasized. Aside from the consideration of the health of the workmen involved, poor ventilation of paint-spray installations usually means inefficient painting and poor drying with attendant loss of time and money.

In its railroad car paint shops at Elizabethport, N. J., the Central Railroad of New Jersey has effectively solved this difficult ventilation problem and at the same time has made provision for warm air to insure the comfort and health of workmen and the rapid drying of painted cars.

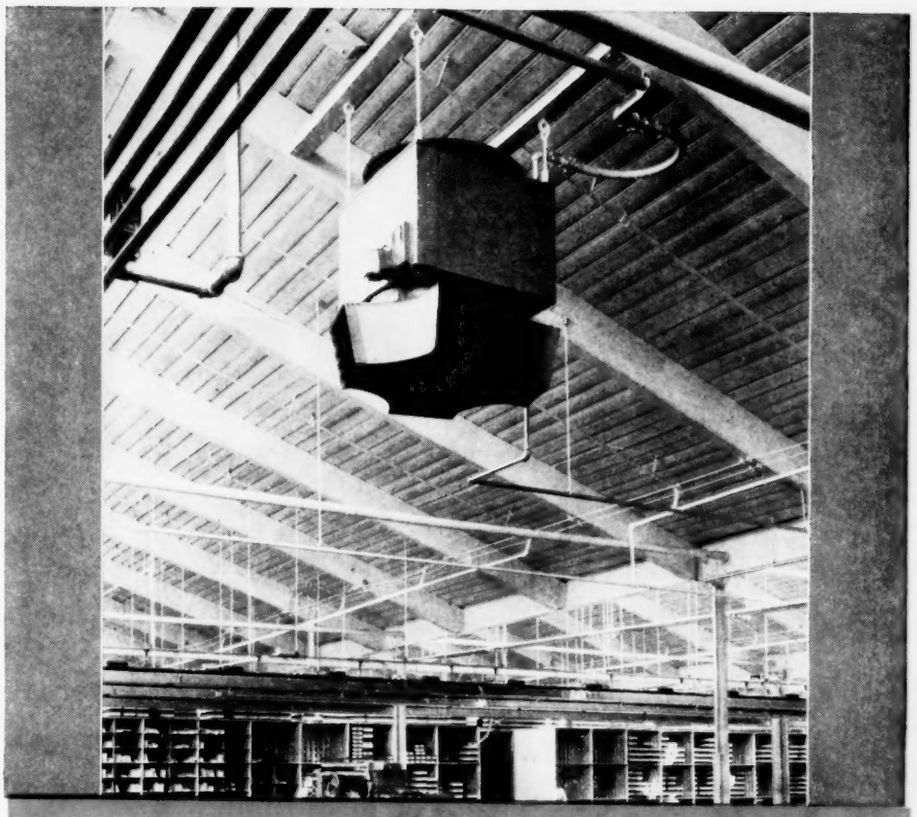
Utilizing two 7½-hp. Wing straight-line duct fans at the fresh-air supply end of the car paint shop, the C.N.J. has coupled with them four Wing variable temperature heater sections. This arrangement permits any temperature variation deemed necessary in the 45,000 cu. ft. per min. fresh-air supply. The temperature variations are automatically controlled by a room thermostat in parallel with a low-limit air-steam thermostat. These variable temperature heater sections are so designed that the heating unit is continually under full steam pressure to eliminate the possibility of bursting the tubes by condensate freezing. Reduction of air temperature is accomplished by changing the damper position and not by reducing steam pressure.

The two straight-line duct fans are mounted inside a penthouse atop the open end of the car paint shop. Outside air is drawn through the louvers in the penthouse doors and passes through a series of "Dustop" filters before entering the duct fans. Directly beneath the fans are located the four variable temperature heaters.

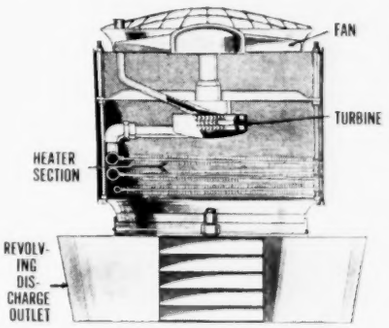
At the exhaust end of the paint-spray room, two 15-hp. Wing straight-line duct fans draw the contaminated air through the water curtain where it is thoroughly washed before being exhausted into the atmosphere. These fans are installed in duct stacks above the roof line and are capable of removing 45,000 cu. ft. per min. of contaminated air through the water curtain.

In the small parts spray booth, two 3-hp. Wing straight-line duct fans draw the spray-laden air away from the work area and through another water wall. It is then exhausted to the atmosphere through a duct stack on the roof.

When the painting of a railroad car has been completed, the painters leave the shop and the variable-temperature heaters are used to raise the temperature of the incoming air to the proper degree to perform the best drying job. This temperature is limited only by the pressure of the steam being supplied to the heater. In this installation the pressure is 50 lb. per sq. in. and each of the heater sections uses 1,000 lb. of steam per hr.



Wing Turbine Driven Heater uses exhaust from fan turbine for heating



Where live steam of any pressure is available, it is possible to heat a plant advantageously by installing Wing Turbine Revolving Unit Heaters. The fan is driven by a Wing Turbine and the turbine exhaust is piped into the heater section. Electric motor and electric power are eliminated as the source of power (steam) is also the source of heat. The revolving discharge outlet distributes the heat to the working level, flowing around obstructions and to remote corners. Workers are pleased with the sensation of fresh, live, invigorating warmth. Write for descriptive bulletin or specific details.

L. J. Wing Mfg. Co. 158 W. 14th Street, New York 11, N.Y.
Factories: Newark, N. J. and Montreal, Canada

Wing

Revolving UNIT HEATERS

Announcing UNITRANE— the NEW Air Conditioning

Out of the Trane laboratories there comes a development that changes many long-standing notions of *what can* and *what cannot* be done with equipment for conditioning air in multi-room buildings.

This development is a device which transforms an ordinary room type unit cooler into a true air conditioner.

MOISTURE CONTROL

An ordinary unit cooler is primarily a device for reducing the temperature of air. As a part of this operation, it may also remove moisture from the air. But moisture removal is *a part of the air cooling process.* In an ordinary unit cooler it cannot be controlled separately. The Trane development provides the missing essential—independent control of temperature and moisture.

It is now possible, with a single, compact room unit, to control both sensible and latent heat in recirculated and ventilation air.

UNITRANE

The new air conditioning system which Trane engineers have designed around this dual purpose room unit has been named the UNITRANE System.

The unit itself is known as UniTrane Type MC. The symbol MC means Moisture Control.

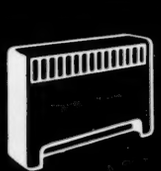
NO DUCTS!

UniTrane—the *new* air conditioning—requires no ducts. It is a true unit system.

Each unit introduces the amount of ventilation air for which it is set—processes it—blends it with processed room air in the desired ratio—and circulates the conditioned air throughout the room.

Each room is separately conditioned in accordance with its particular requirements. Each has its own temperature control.

TRANE


CONVECTOR-RADIATORS

UNIT HEATERS

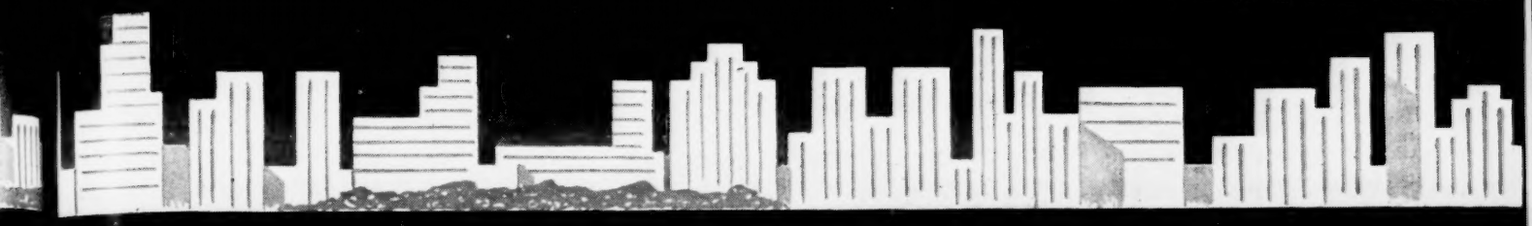
HEATING COILS

PUMPS

HEATING SPECIALTIES

COOLING COILS

COMPRESSORS



INSTALLATION SIMPLIFIED

iTrane uses water as a heating and ling medium. The same simple piping uit that supplies warm water to the rs for heating in winter also supplies led water to the units for cooling in mer. Changeover from warm water to d water is automatic.

ENGINEERING SIMPLIFIED

e UniTrane piping circuit is as simple as piping of a straight hot water heating tem for any given building.

ection and installation of units is equally ple.

Elimination of ducts eliminates the bulk of the design and application problems.

iTrane is quick, clean, easy to handle old or new buildings. Careful product neering conserves the consulting en- eer's time for producing an installation exactly meets requirements.

BROAD APPLICATION

Trane is for ***large*** *multi-room buildings.* s exactly what is required for hotels, pitals, office buildings and similar struc- s. Each room, office or suite has its own vidually controlled air conditioning the r around.

Trane is for ***medium-sized*** *multi-room dings.* Since this is a true unit system, system may be used effectively in dings of medium size as well as in large dings.

The UNIT OF DESIGN is the room. Whether there are 20, or 200, or 2000 makes no basic difference.

UniTrane is for ***comparatively small*** *multi-room buildings.* Any building that contains enough rooms to warrant a central boiler and a central source of chilled water is large enough for this *new* air conditioning.

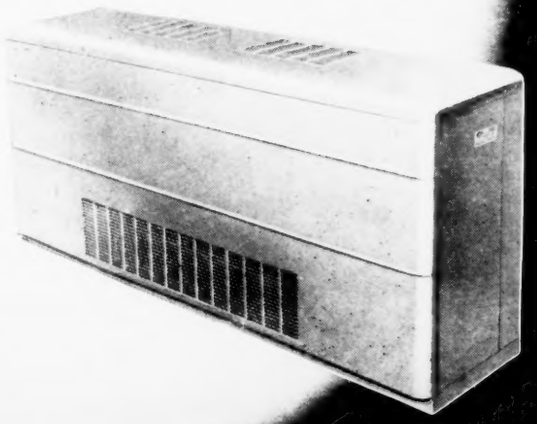
DESIGN AND APPLICATION DATA

Your Trane Sales Office now has advance data on this important Trane development. Information is being placed in the hands of architects, engineers and contractors as rapidly as possible. Regular printed data is now on press.

If you agree with Trane engineers that this new system heralds a new era in multi-room air conditioning, you will want us to reserve copies of the new data for you. We'll gladly do so on request.

THE TRANE COMPANY, LA CROSSE, WISCONSIN. *Also:* TRANE COMPANY OF CANADA, LTD., TORONTO, ONTARIO.

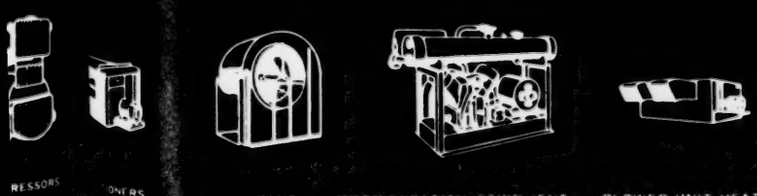
THE MOISTURE CONTROLLER. Designed around a series of compact axial flow heat exchangers, this entirely new and different device has made possible the development of a radically improved unit air conditioner for multi-room buildings. *Patent applied for.*



UNITRANE TYPE MC ROOM UNIT. The unit cooler, incorporating the new Trane Moisture Control element, becomes a true room air conditioner. It handles both room air and ventilation air. It *controls* moisture as well as temperature. It cleanses *all* air.

TRANE

HEATING AND AIR CONDITIONING

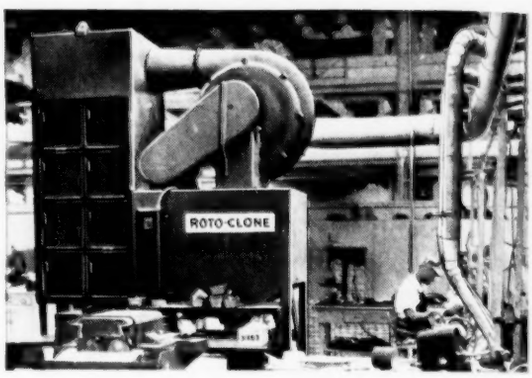


RESSORS ONERS FANS REFRIGERATION EQUIPMENT BLOWER UNIT HEATERS

ROTO-CLONE eliminates "dust bowl" in tool crib

THERE are 28 dust-producing grinders in this open tool crib. But the workers breathe clean air and no trouble-making dust finds its way to nearby precision tools and intricate assembly operations.

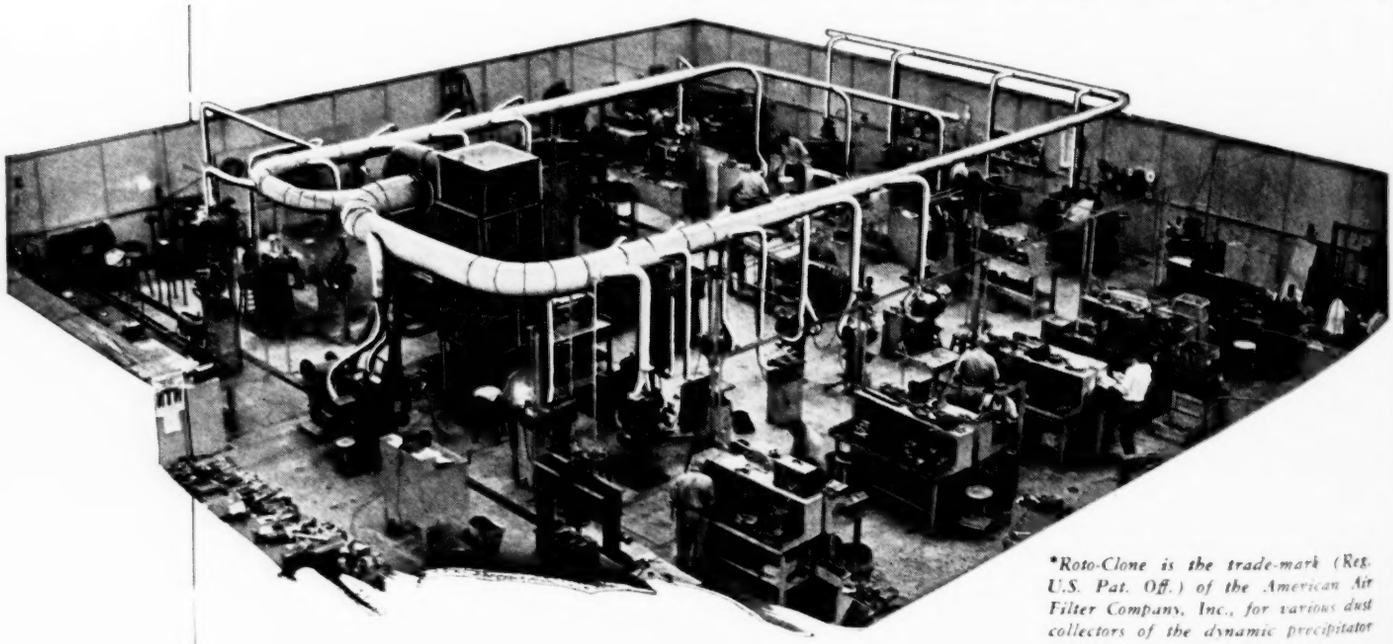
The reasons—Roto-Clone* is on the job. Pictured below is a view of the Type D Roto-Clone system serving these grinders. At right you see a close-up of the Roto-Clone with viscous filter after-cleaner to permit recirculation of the cleaned air.



The Type D Roto-Clone is a dynamic precipitator combining the functions of exhauster and dust separator in one self-contained unit. Uniform air volume assures high collection efficiency under all operating conditions. It is economical to operate; can be located at or near dust source and may be installed as a central system or to serve a single operation.

When you select the Type D Roto-Clone you pick the favorite, because more grinding wheels are exhausted by this dynamic precipitator than any other make of dust collector. For complete information, call your local AAF representative or write direct to—

AMERICAN AIR FILTER COMPANY, INC.
294 Central Ave., Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

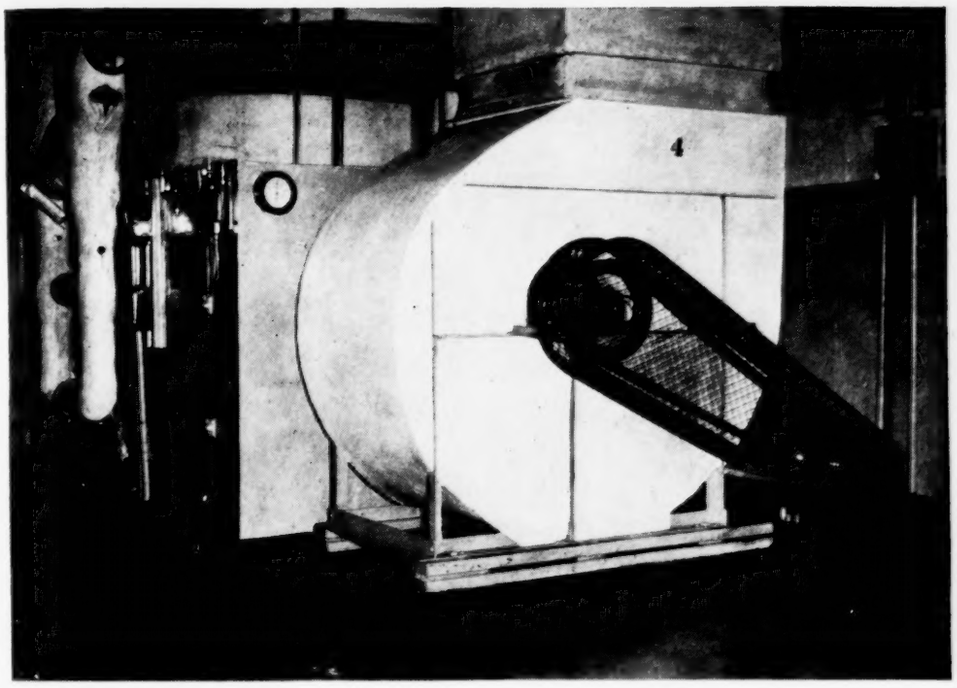


*Roto-Clone is the trade-mark (Reg. U.S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

AAF

ROTO-CLONE®
DUST CONTROL EQUIPMENT

AIR EQUIPMENT TO HELP YOUR BUSINESS



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★ RATED CAPACITIES **you can count on!** Backed by seventy years of "air experience", "Buffalo" fans and air conditioning units are giving performance as **good** — or **better** than specified!

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★ SIMPLIFIED INSTALLATION! Here, the full choice of arrangements, space-saving designs and models makes for a simpler, easier, more satisfactory installation.

★ PROVEN RESULTS! The thousands upon thousands of "Buffalo" installations giving economical, reliable service are ample testimony that you can be **sure** of "results as specified" when you pick "Buffalo". WRITE FOR "Buffalo" BULLETINS ON YOUR NEXT AIR PROBLEM!

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CUTTING AIR COSTS IN EVERY BRANCH OF INDUSTRY

Wanted...a Compass

THE world gropes for a road to peace and security. It expects help and guidance from America--a compass to show the true way.

America *has* a true compass. It is our concept of freedom for the individual. Personal liberty has made us the envy and hope of the peoples of the earth. *You, as a community leader,* have a duty to marshall public opinion to guard and strengthen this priceless heritage that built our nation.

Only through the wise, courageous effort of community leaders can we keep America the impregnable home of liberty and freedom, and reach a lasting world peace founded on right and justice.

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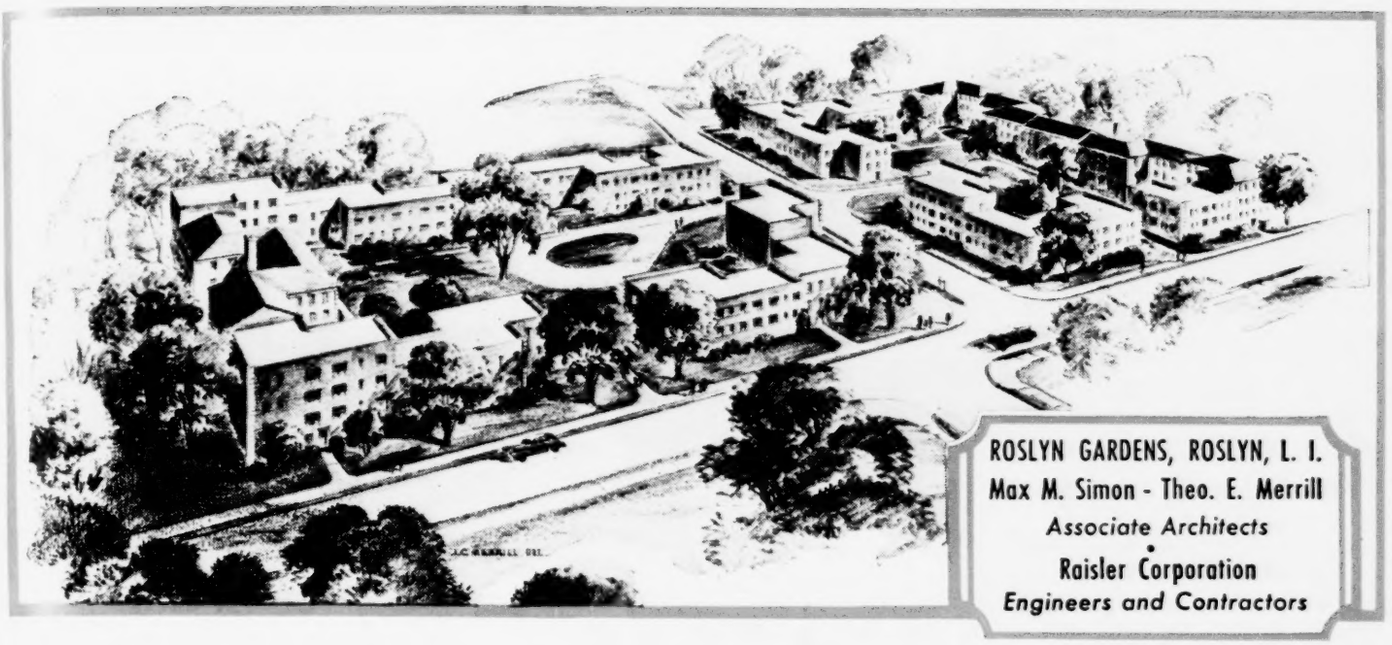

ROSLYN GARDENS, ROSLYN, L. I.
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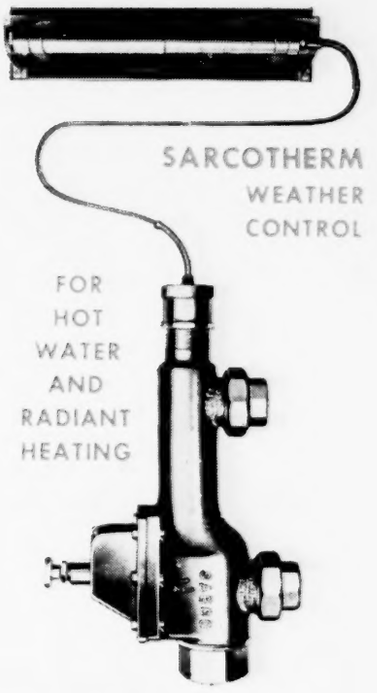
Another BIG APARTMENT PROJECT SELECTS SARCOTHERM

Simplified Heat Control



The engineers of this six acre F.H.A. development, providing 217 moderate priced apartments, assured utmost heating comfort by deciding on Sarcotherm Control for the forced hot water system.

"Simplicity and Low Cost" were again the deciding factors. More and more engineers are realizing that the luxury of a control that modulates for both outside and inside temperatures is also an economy—in first cost, in fuel, and in maintenance costs.

Sarcotherm has thrived on comparisons. On plans, on price, in service, the more you compare, the better Sarcotherm looks. Why not see some of the many jobs in your territory?

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Sarcotherm

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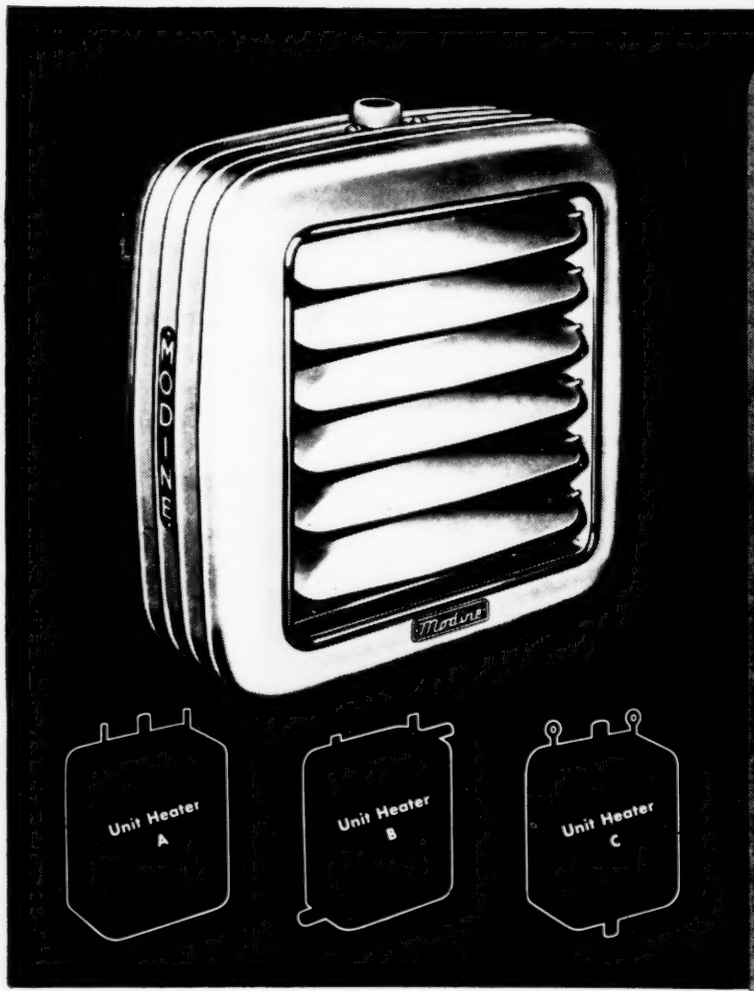
SARCOTHERM CONTROLS, INC. • Empire State Bldg. • NEW YORK 1, N. Y.

To everyone about to order unit heaters, Modine says,

"Look before you buy!"

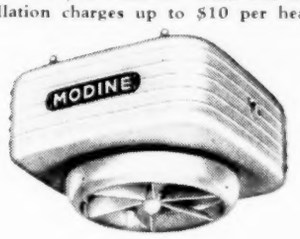


MODINE MAKES THIS SPECIAL OFFER

Get the facts *RIGHT ON YOUR DESK.* Call your Modine Representative today to show you an actual Modine Unit Heater . . . to explain its features in detail. You'll like its attractive appearance, sound engineering, rugged construction. Examine Modine — compare it with other unit heaters before you make your decision.

Look at Modine Suspension!

See how this patented feature eliminates hanger-rods . . . speeds installation . . . lets you direct heat where you want it. Find out how it cuts installation charges up to $10 per heater.



Look at Modine Beauty!

Check Modine's clean, simple lines, beige-gray color, sparkling chrome trim. See how this attractive Modine appearance combines with quality Modine performance to give you the finest in unit heating today.

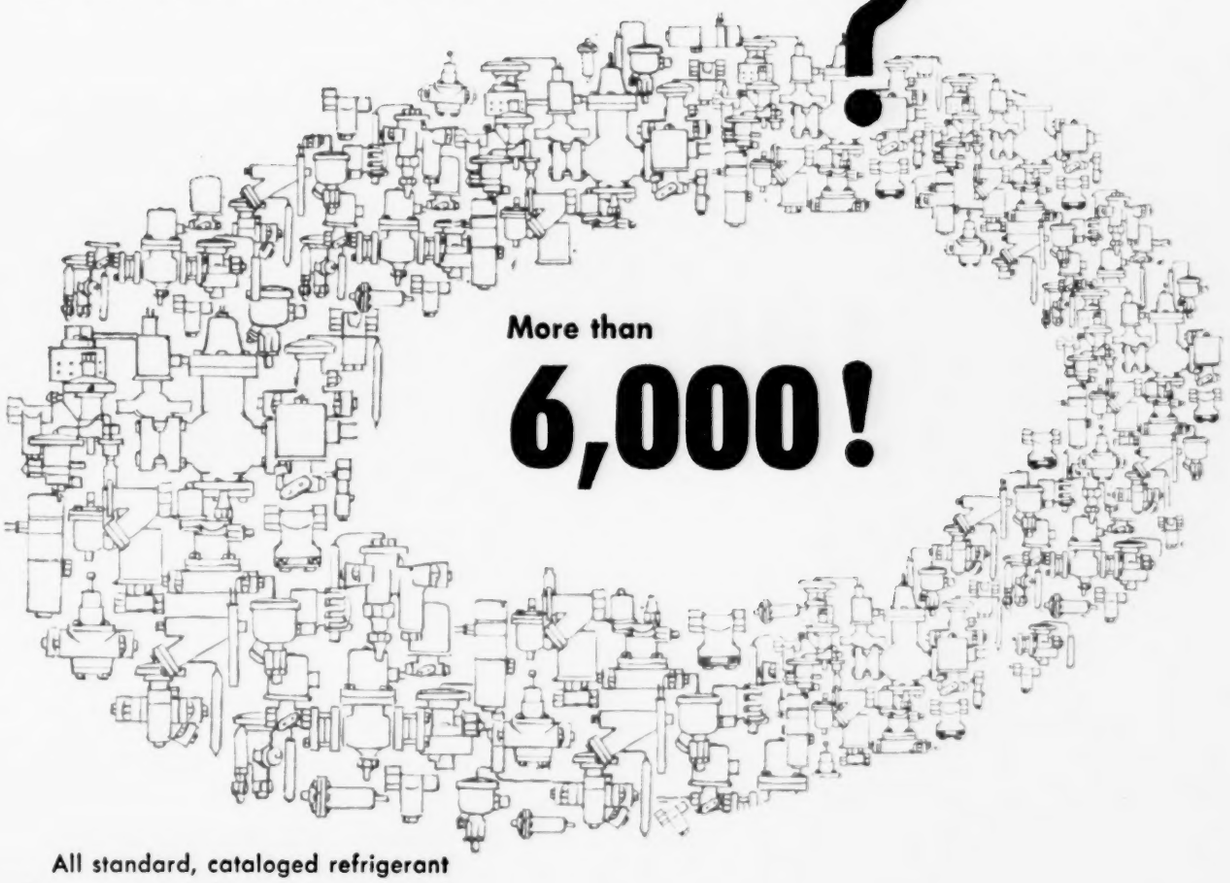
YES, look before you buy.. and you'll buy Modine!

It's easy to see the difference between Modine unit heaters and all other makes. One look will show you Modine is the leader — the only unit heater which gives you ALL these important features. Modern Beauty. All-Copper Coils. Peak Performance. Easy Installation. Smooth Operation. What's more, you can choose from 3 types and 47 capacities to meet your specific heat, air delivery, height and location needs.

When you look before you buy, you'll see why Modine leads the field. Call your Modine Representative for further details. He's listed in the "Where-to-Buy-It" section of your phone book. Or write direct. Modine Mfg. Co., 1511 Dekoven Avenue, Racine, Wis.

Modine UNIT HEATERS

How many valves in "THE COMPLETE LINE" ?



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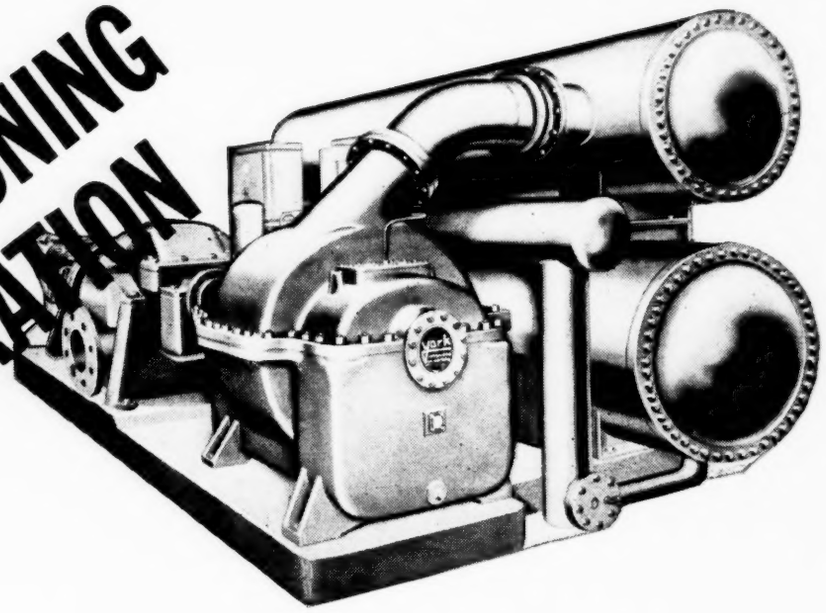
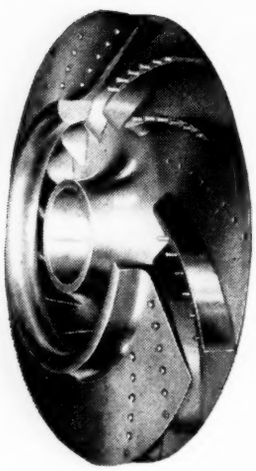


With Turbo Compressors



ONLY YORK HAS

Stainless Steel Impeller Wheels . . .

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ONLY YORK HAS

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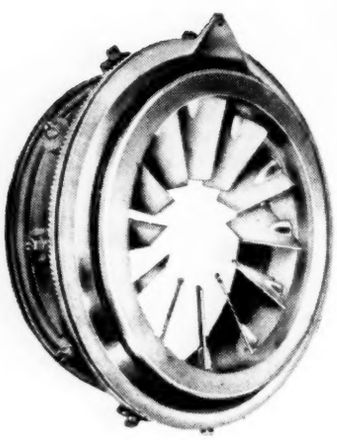

Exclusive with York, a *gradual acting* multi-radial vaned control, constructed of accurately machined non-ferrous materials. Ring and pinion gear movement insures smooth vane opening and closing—multiple vanes give *precise adjustment* of refrigerant flow down to minimum capacities . . . impart a *flow pre-rotation*. Result—inherent *stability of operation* over the widest capacity ranges.

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York Corporation, York, Pennsylvania.

YORK *Refrigeration and Air Conditioning*

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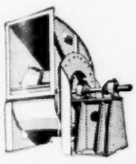


Industrial Fans

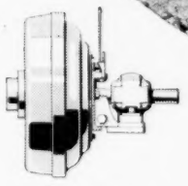
Air Conditioning Equipment

Dust Collectors

Heating and Cooling Coils

Ventura Ventilating Fans

Capillary Air Washers



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Industrial Unit Heaters

Famed for weather and beauty:
Outdoors — Sugar Hill, New Hampshire.
Indoors — American Blower Equipment.

Be a weather prophet *(and profit)*

Want cool and delightful weather, like that pictured above, even on the hottest summer days?

Want cozy warmth in the dead of winter?

Want fresh air in every nook and corner?

Yes, you can make *indoor* weather to meet the individual needs of any business if you install American Blower Equipment for cooling, heating, ventilating and air conditioning.

All time-proved, dependable American Blower Equipment insures peak performance and greater satisfaction for your customers — assures more profit for you, too. Try it! Phone the nearest American Blower Branch Office today for data.

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Dependable Heat for a Lifetime

KEWANEE☆

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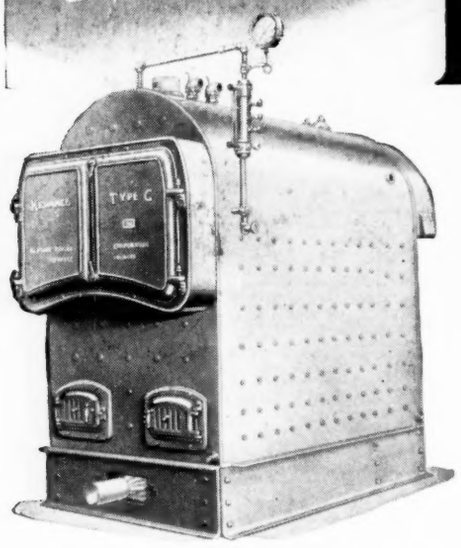

Such Kewanee features as the Corrugated Crown Sheet which adds strength and heating efficiency have made Type "C" the fastest selling boiler for heating big buildings.

Owners *know* that a Kewanee in the basement means a lifetime of dependable heat and lower fuel bills. *Tenants know* that a Kewanee heated building will be warm and comfortable always, even in zero blasts.

Kewanee boilers increase the selling and renting value of any building. That's why they are so universally used in fine structures of every type.

Whether fired by hand or mechanically there is a Kewanee just right for every heating purpose . . . from small homes to the biggest factory or skyscraper.

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EMERGENCY INSTALLATION

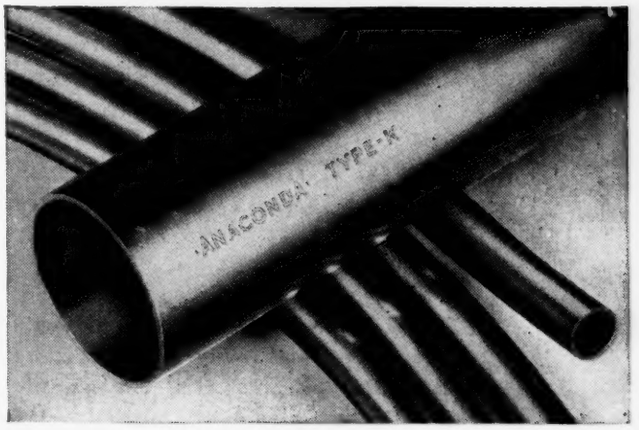
proves Copper Tubes Cost Less . . .

FACED with last winter's gas shortage, an automotive parts manufacturer converted all drying and annealing ovens to oil heat on short notice. The job required 5,000 ft. of 1¼" fuel lines, for which copper tubes were used only because the kind of rustable pipe that costs less by the foot was not immediately available.

On completion of the job, however, this manufacturer discovered what every experienced piping contractor knows, that installed cost for durable, rustless, corrosion-resistant copper was less than he would have paid for rigid pipe of less durable metal. These savings are savings in time, made possible by speedy, solder-type fittings, long runs of copper tube that may be bent around obstructions and corners . . . savings that increase as the job becomes more complicated.

For detailed information on the industrial uses of Anaconda Copper Tubes, write for Publication C-24.

4877



Anaconda Copper Tubes are stocked by wholesale distributors from coast to coast. Types K and L in standard sizes are furnished soft in 60-ft. coils, and hard and soft in 20-ft. straight lengths. Type M Tubes 1¼" and larger are furnished hard in 20-ft. straight lengths for waste, vent and drainage lines.

ANACONDA
from mine to consumer

Anaconda

COPPER TUBES

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

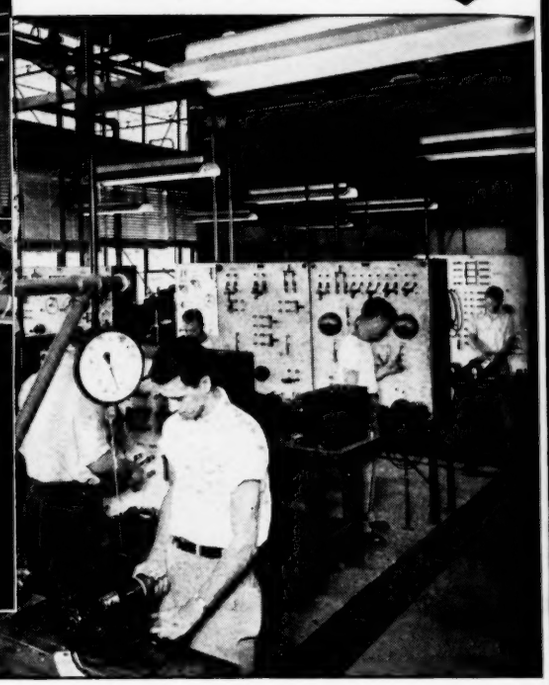
Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

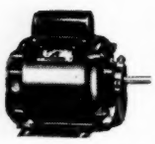
Tell it to our draft board..

Motor design starts on the drafting board, to predetermined requirements.

Sample motor, before shipment to customer, receives laboratory tests.



and get uniform performance to fit your application, with a motor that's *Twin-gineered*

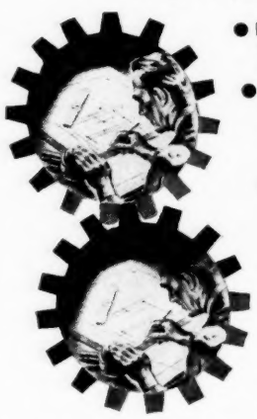


1/20 to 5 H.P. AC and DC

Emerson-Electric's "draft board" is always in session . . . an efficient, smooth-geared organization, competently staffed and equipped to solve the design problems relating to power applications for motor-driven appliances.

The "draft board" is eager to collaborate with *your* engineers . . . to combine your knowledge of product design with our *know-how* acquired in 58 years of motor design, application, and manufacture. Such collaboration — *Twin-gineering*, we call it — is likely to save you much costly engineering "back-tracking" later, and may suggest manufacturing short cuts or improvements which will give your product added market advantages even beyond those assured by a trouble-free, soundly-engineered power application. There is no charge for Emerson-Electric design and planning services . . . your inquiry is invited on this first vital step in *Twin-gineering* . . . the successful system that *meshes* engineering minds to produce better motors for the job at hand.

Here's how TWIN-GINEERING *"follows through"* to give you the perfect power application:



- **DESIGN SERVICE:** Our "draft board," in consultation with your own engineers, plans the best power application for your particular need.
- **PRODUCTION:** An Emerson-Electric Application Engineer, assigned to each project, personally directs the writing of specifications and performance requirements, from which production is planned.
- **QUALITY CONTROL:** Rigid testing of both materials and motors is carried out by inspectors in accordance with instructions established by the Application Engineer.
- **DELIVERY AND ORDER CONTROL:** With the benefit of adequate facilities, production of your order is handled on a predetermined delivery schedule, geared to your requirements.
- **FIELD LIAISON:** The Emerson-Electric Territorial Representative, provides direct liaison on all phases of the power application, from inception to final delivery and marketing of the product.

THE EMERSON ELECTRIC MFG. CO.
ST. LOUIS 21, MO.

EMERSON ELECTRIC

MOTORS · FANS — APPLIANCES

...il Company

...Without doubt, YARWAY ...team Traps are finest traps ...ever built. All trap replace... ...ments will be YARWAY ... hereafter."—Oil Company, Texas.

Cleaning Plant

"As soon as we installed the YARWAY trap our trouble ended. Since then, when other traps gave trouble, we put in YARWAYS and they always did a much better job. Now we use all YARWAY traps," says Maintenance Engineer of large mid-western cleaning firm.

Dairy Company

"YARWAY Traps have been a life-saver here. Used many different makes before trying YARWAY a year ago. Haven't touched them since. Trying to get management to buy more."—Large Wisconsin dairy.

Dye Works

...a good many YARWAY Traps ...—like them very much on dryers. ...e up little room and discharge ... ...densate as fast as it comes through ...e line, causing coils to heat up faster ...d hold steady temperature."—Globe ...ye Works, Philadelphia, Pa.

SPEAKING OF STEAM TRAPS

Laundry

"Ironer is so hot it sizzles after putting YARWAY trap on in place of a bucket trap. Run heavy spreads through ironer once and they are dry. Pulling out all bucket traps and will replace with YARWAYS."—Farina Laundry Co., Vancouver, British Columbia.

Power Station

...A great many YARWAY Traps are ...ed here and have been very success-...l... some of these traps have been ... use since 1939 and have given ...bsolutely no trouble."—Herkimer ...Municipal Power Station, Herkimer, ...N. Y.

Florist

"Coal bill last winter was $5,000 less than previous winter. Didn't know whether they could give YARWAY Traps all the credit, but they were entitled to a big share of it."—Meyers and Santman (Greenhouses), Wyndmoor, Pa.

Hospital

"Ten years ago replaced an.....trap with a tiny ½" #60 YARWAY on an ironer. Never had such good results before. Trap has never been opened and still going 100%. Since then have bought nothing but YARWAY Traps and will specify them for new addition."—Northern Wisconsin hospital.

Textile Plant

"One large press formerly equipped with a bucket trap wouldn't heat lower platen. A ¾" YARWAY Trap was installed and since then full production has been maintained. This represents an increase of 20% in production."—Southern textile mill.

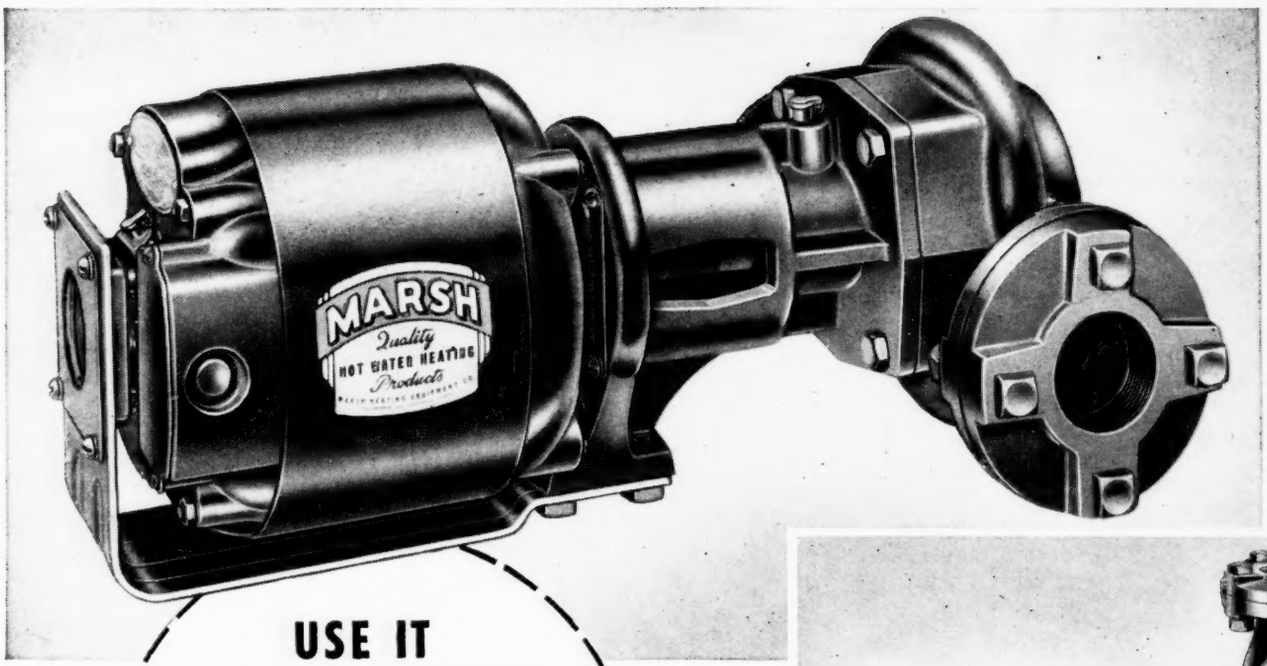
ACTUAL SIZE
½" TRAP

NEARLY 600,000 BOUGHT!

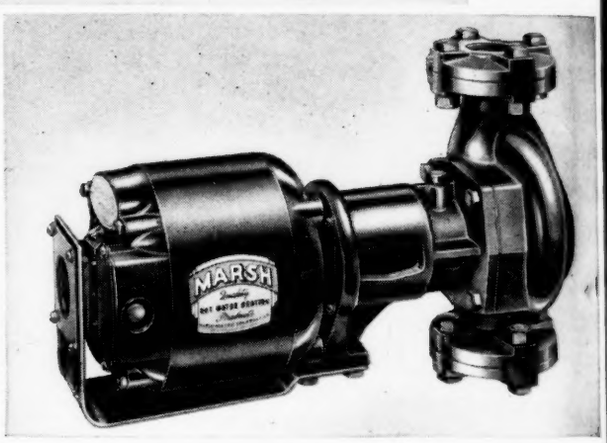
ORDER YARWAY TRAPS FROM YOUR NEAREST MILL SUPPLY DEALER. FOR NAME AND FREE TRAP BOOKLET, WRITE...

YARNALL-WARING COMPANY 104 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY IMPULSE STEAM TRAP



USE IT HORIZONTALLY— OR VERTICALLY



Marsh TWO POSITION Circulating Pump

Here's a circulator for hot water heating systems that is quickly adaptable to either vertical or horizontal lines. It is equally efficient in either position. The change in flow is speedily and easily accomplished by removing four bolts and swinging the pump into the desired position, as shown.

Quality construction and long-life design throughout distinguish this pump. High hydraulic efficiency is obtained by the balanced die-cast construction of the bronze impeller, which results in exceptionally close fit to the bored diameter of the body.

The assembly is outstandingly sturdy, for trouble-free operation. A special rubber coupling, with brass inserts, is secured to the motor shaft and pump shaft to prevent any transmission of vibration. A retainer ring, plate, and gasket secure the pump shaft in the bearing housing on the motor side.

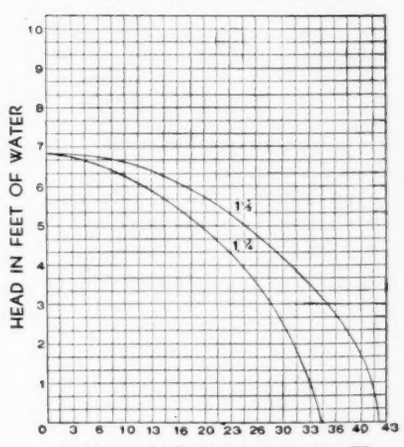
Proper alignment of the motor is maintained by securing it to a steel support and cushioning it in rubber shock absorbers. This motor, a continuous-duty, 1/6 H.P., single phase, 60 cycle, 100 volt, is equipped with an automatic overload relay. It is guaranteed for 18 months against defective materials and workmanship.

Positive lubrication at all times is insured, since the pump shaft rotates in an oilite bearing which is fed through an oil cup in the housing.

A carbon seal and a neoprene rubber seal surround the pump shaft to form a water tight seal, preventing water from entering the bearing assembly. Tension is maintained on this seal by a spring, and a highly finished bearing surface is maintained between the carbon seal and the bearing housing.

Every pump is given a running test to insure trouble-free operation.

CIRCULATOR CAPACITY CHART



No.	Pipe Size	Std. Motors 110 V, 60 Cycle Single Phase	Face to Face	Approx. Shipping Weight
MC-1	1¼"	1/6 H.P.	8-11/16"	44#
MC-2	1½"	1/6 H.P.	8-11/16"	44#

MARSH HEATING EQUIPMENT COMPANY

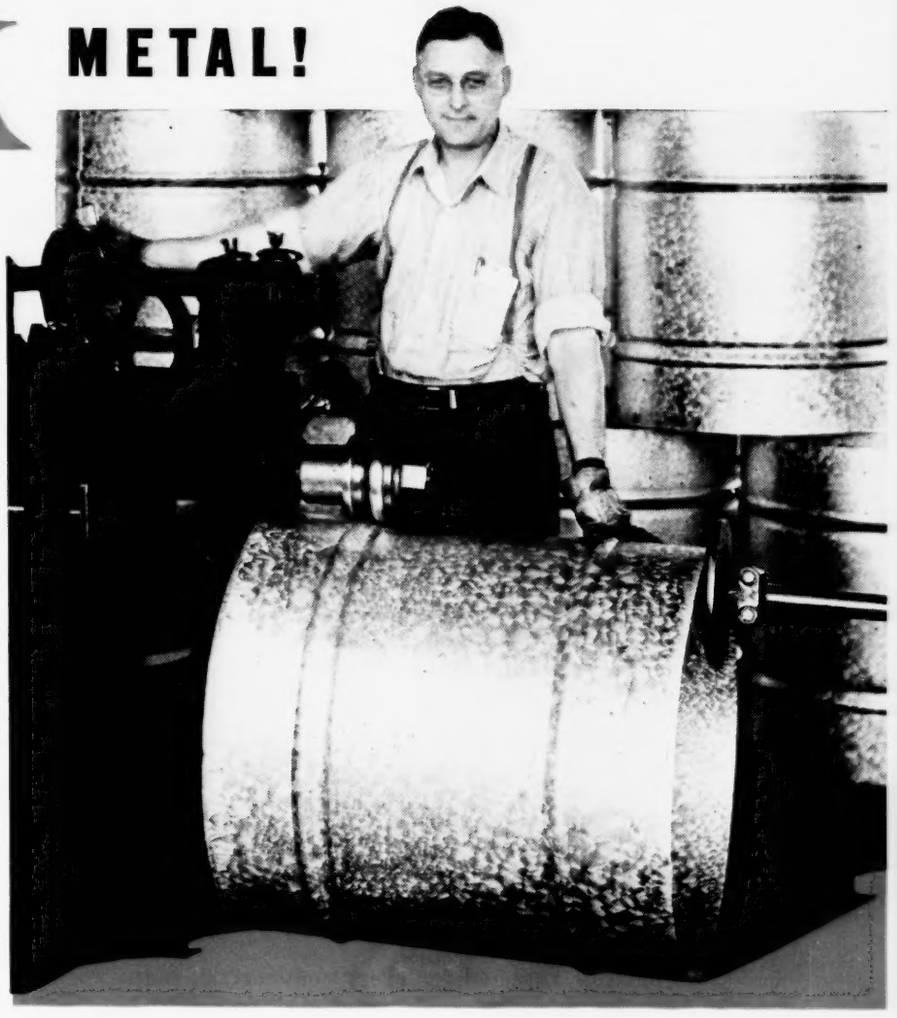
Quality Heating Specialties

Division of Jas. P. Marsh Corporation, Dept. U, Skokie, Illinois

Since 1865

UILD PREMIUM PRODUCTS

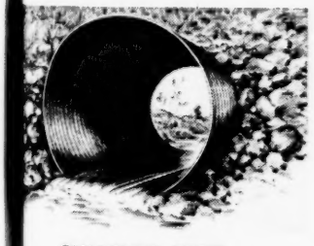
ITH KONIK METAL!



Today's customers look for the best products their money can buy. That's why re and more manufacturers are using Continental KONIK. They know that whatever make of steel will provide longer, better rice if it is made of KONIK metal.

KONIK, an open hearth alloy steel containing closely controlled proportions of copper, nickel and chromium, has greater strength toughness . . . it provides extra resistance rust and corrosion.

Commercial use of KONIK will open up economies for those who use steel sheets. withstands greater abuse in fabricating, causes fewer rejections. It solders and welds readily its uniform zinc coating withstands difficult ming operations. Continental KONIK metal ps make better products . . . helps build nd repeat business. Call your jobber, or te Continental.

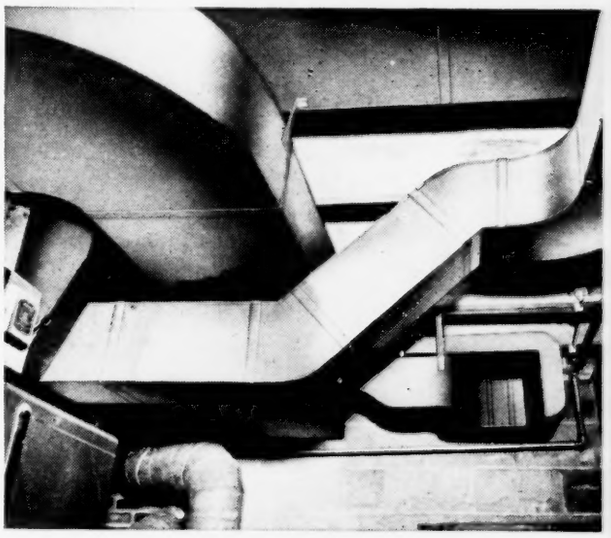


CULVERT PIPE

CHAIN LINK FENCE

USE KONIK METAL WHEREVER RESISTANCE TO RUST IS IMPORTANT!

● Continental KONIK has been proved under the most rugged conditions. It has proved its value over many years for culvert pipe in use under difficult and varying conditions. Continental Chain Link, the only fence made of KONIK, has provided property protection for industry, institutions and residences the country over. If your installations, inside or outside, call for galvanized sheets, you can depend on extra durability from KONIK metal.



CONTINENTAL STEEL

CONTINENTAL STEEL CORPORATION

GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF STEEL SHEETS, including Continental GALVANIZED, COPPER-STEEL Galvanized, KONIK steel sheets Galvanized, UNIFORM SPANGLE Galvanized, DULL COAT, Continental GALVANNEALED, ELECTRICAL, Hot Rolled Pickled, and many styles of Formed Roofing.

ALSO, Manufacturer's Wire in many sizes, shapes, tempers, and finishes, Continental Chain Link Fence, Nails, and other steel products.

High Combustion Efficiency on Lowest Cost Oils

. . . *with* PETRO!

Maximum heat return from each dollar of fuel cost . . . what building owner doesn't want *that* kind of heating plant operation?

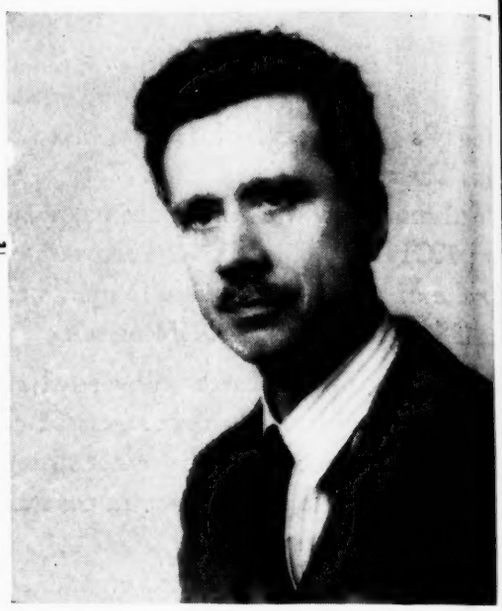
According to the experiences of such prominent architects and engineers as Mr. Severud, a Petro meets this and every other heating requirement with lowest cost oils. Designed to deliver high combustion efficiency, Petro develops more heat from less oil. Consistent performance year in and year out with minimum maintenance can be taken for granted. Built by the largest, oldest, exclusive manufacturer of oil burning equipment, a Petro incorporates the workmanship, engineering and progressive design resulting from more than forty years' unmatched heating experience.

Petro can be supplied for every commercial, industrial or domestic specification. You'll find it satisfies your most exacting requirements.

INDUSTRIAL MODELS: No. 5 or No. 6 fuel oil; manual, semi-automatic or automatic operation; 8 sizes to 450 bhp. Thermal Viscosity preheating.

DOMESTIC MODELS: No. 3 or lighter oils; conversion and combination-unit types, 7 sizes. Patented "Tubular Atomization."

FULL DATA on Petro Industrial Burners are in catalog files of Sweet's and Domestic Engineering. Details on Petro Domestic Burners available in separate catalog. Copy of either sent gladly on request.



One of the country's outstanding consulting engineers, Mr. Fred N. Severud has been identified with the engineering profession for the past quarter century. He has served as consultant on such well-known structures as: Rome Air Depot, Rome, N. Y.; Lillian Wald Housing Project, New York, N. Y.; Tripler General Hospital, Hawaii; Veterans Hospital, Wilkes-Barre, Pa.; Hotels Interamericanos, Panama; Broadcasting Station K.N.X., Los Angeles, Calif.; and the Office Building and Broadcasting Station, Reykjavik, Iceland. Mr. Severud expresses this opinion of oil heat:

"Where we have used Petro Systems, we have found that a large part of their economy record is due to Petro's Thermal Viscosity system for burning lowest cost oils at high combustion efficiency and with completely automatic operation. This means maximum heat return from each dollar of fuel cost and a labor expense limited to nominal observation.

"We have found, too, that the Petro organization gives intelligent thought to installation details and specifications, and their service extends to a continued interest after the system is installed."

PETRO
REG. U.S. PAT. OFF.

cuts steam costs

PETROLEUM HEAT AND POWER CO. • Makers of Good Oil Burning Equipment Since 1903 • Stamford, Connecticut

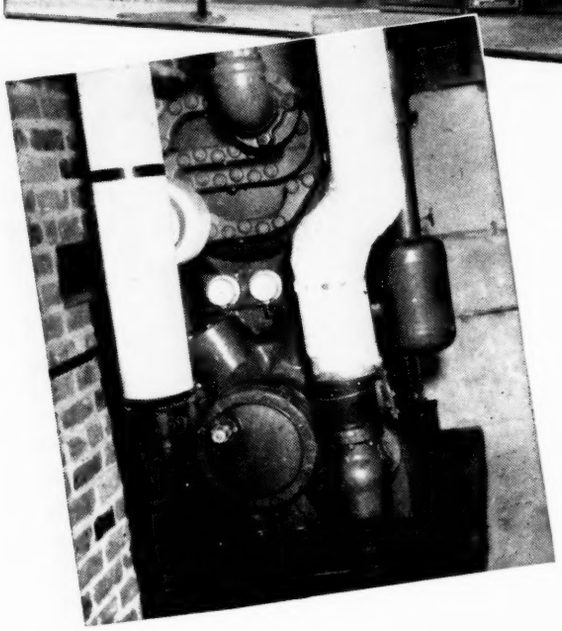
The mill that makes textiles without rejects has never been built . . . but plenty of mills today are making yarn and cloth with negligible losses due to soilage from airborne dust and dirt. Raytheon has proved in leading textile mills of all types how easily dust, dirt, soot and grime can be removed from the air electronically by Raytheon Precipitators. And there's every reason to be sure that it will pay — *and pay handsomely* — in your mill. Why not talk with a Raytheon air cleaning specialist. Just call the nearest Raytheon office or write for complete information.

RAYTHEON PRECIPITATOR
ELECTRONIC AIR CLEANER

RAYTHEON

Box-Office Builder

FOR OVER 10 YEARS!



Inset view of Model 7-H, 40-horsepower Chrysler Airtemp compressor serving the President Theatre, Philadelphia, Pennsylvania.

Chrysler Airtemp Air Conditioning Provides Dependable Draft-Free Cooling for 1100-Seat Philadelphia Theatre

Wise theatre owners across the nation have discovered the importance of air-conditioning in building box-office . . . and in hundreds of instances owners of Chrysler Airtemp Air-Conditioning have learned the value of relying on this famous name. Year in, year out—for over 10 years—the husky 40-horsepower Chrysler Airtemp Compressor serving Philadelphia's President Theatre has hummed along smoothly . . . providing dependable, draft-free cooling, with minimum service and maintenance expense.

The *right* air-conditioning system can be a big business builder . . . so depend, as so many do, on *Chrysler Airtemp* . . . the name that stands for thrifty, reliable air conditioning. For complete information, call your local Airtemp dealer . . . or write us direct.

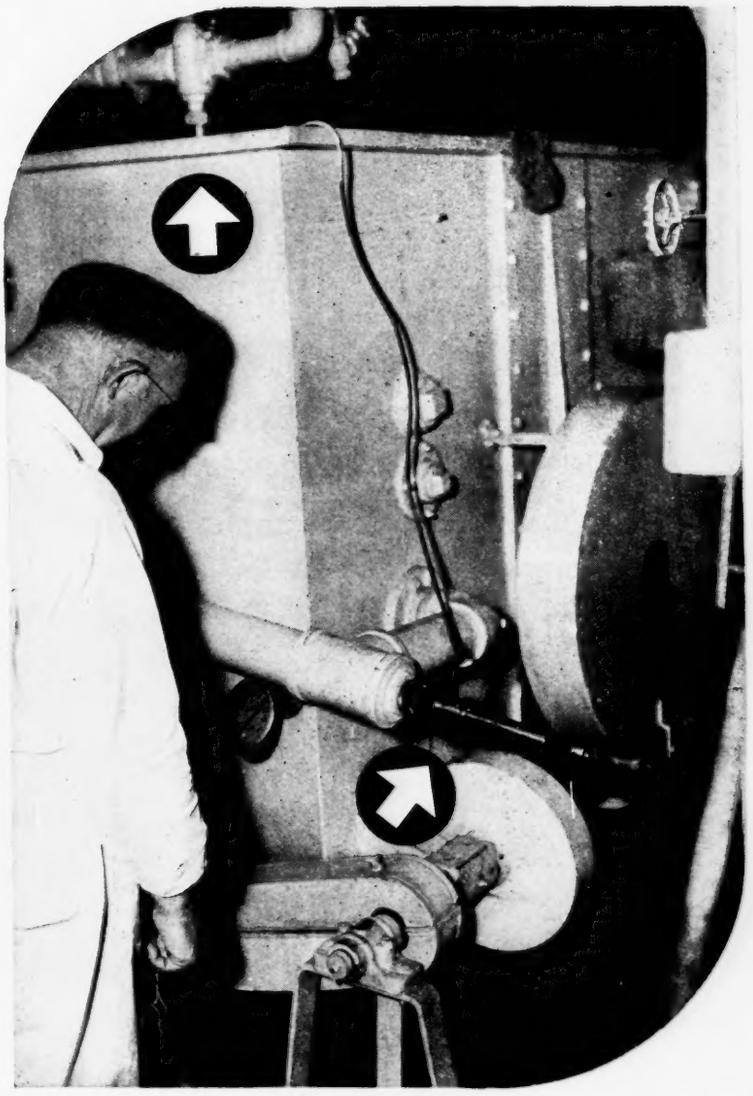
AIRTEMP DIVISION OF CHRYSLER CORPORATION
Dayton 1, Ohio
In Canada: Therm-O-Rite Products, Ltd., Toronto

CHRYSLER AIRTEMP
DIVISION OF CHRYSLER CORPORATION

Chrysler Airtemp

AIR CONDITIONING
HEATING • COMMERCIAL REFRIGERATION

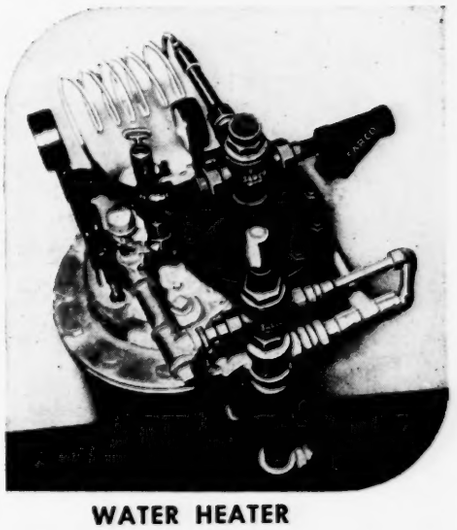
HOW SARCO SAVES WATER



CAN COOLING

This can cooler handles 40 No. 10 tins of chocolate and cooked foods per minute. The water temperature must never exceed sixty degrees, but the load and the incoming water temperatures vary. The simple hook-up of a Sarco TR-21 regulator holds the tank water within the required limits, day after day, without supervision. The water saving alone paid for the change in a few months and can cooling is now automatically uniform.

Each oil cooling system on a battery of plastic presses required a full stream of city water—a six inch pipe running wild at $500 a month for the plant. Sarco Control reduced the stream to a trickle and the entire battery and all air compressors are being Sarco equipped with a total saving estimated at $300 a month. Ask for Catalog No. 700.



WATER HEATER

You also can save hot water with Sarco by having temperatures correct at all times. The Instantaneous Water Heater shown at the right has two Sarco Controls, one for the hot water and one for blended water. Catalog No. 600.

230

SARCO

SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

AEROFIN

HEAVY DUTY HEATING COILS

for Operating Pressures 25 to 450 p. s. i.

Specially designed extra-rugged coil for unusually heavy duty. Continuous tube construction protects interior of coil against corrosion by positive and continuous purging of oxygen, carbon dioxide and other gases.

Each row is removable and replaceable. Rows up to 4' tube length are made of one continuous tube. Rows of 4' 6" and greater tube length contain only one brazed joint. All header joints are outside the coil casing – there are no internal joints to leak.

Operating pressure, 25 to 450 p.s.i.; temperature up to 550° F. Pressed steel headers heavy 1" copper tubing and copper fins permanently bonded and solder-coated for added protection. Galvanized iron casings. Highly efficient. Fast heating. Compact. Write for complete ratings and specifications.

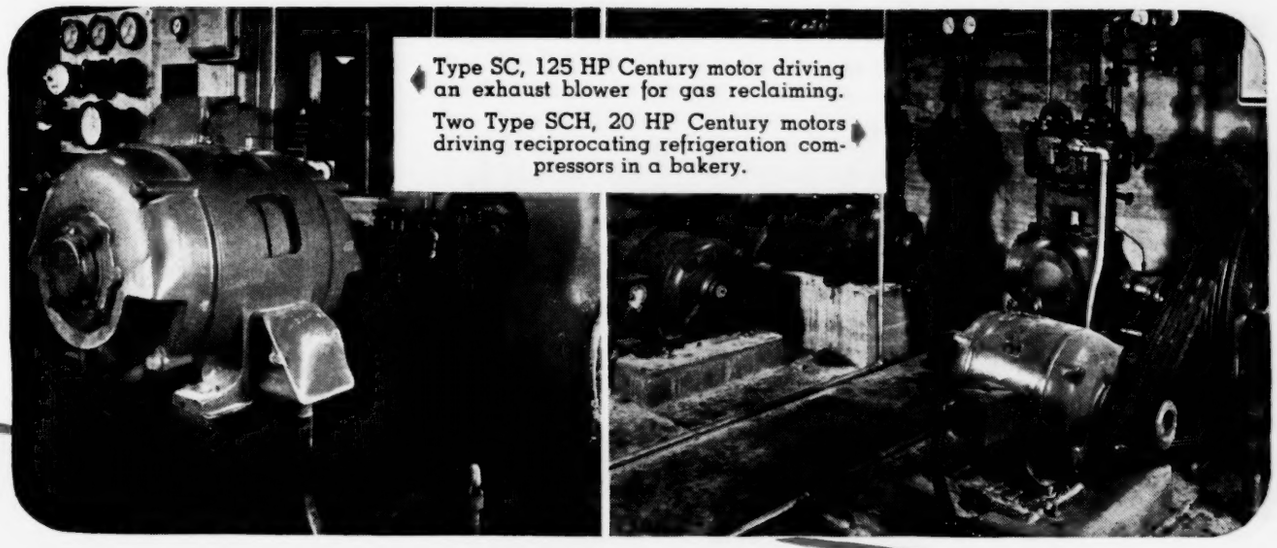
AEROFIN CORPORATION

410 South Geddes St. SYRACUSE 1, N. Y.

NEW YORK • CHICAGO • CLEVELAND • DETROIT • PHILADELPHIA • DALLAS • MONTREAL

COMPLETE LINE OF STANDARD COILS FOR ALL TYPES OF SERVICE

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

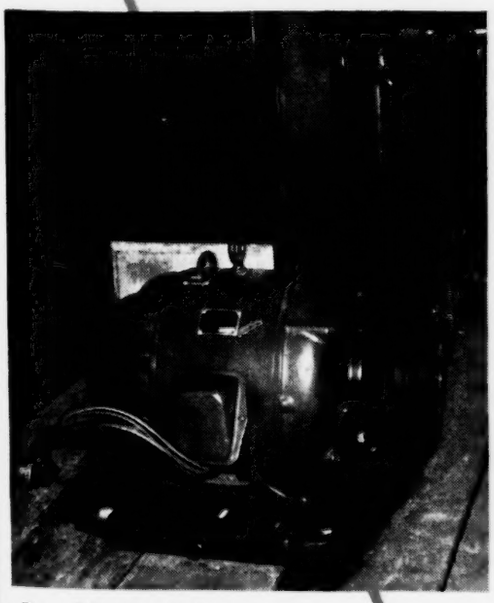


Type SC, 125 HP Century motor driving an exhaust blower for gas reclaiming.

Two Type SCH, 20 HP Century motors driving reciprocating refrigeration compressors in a bakery.

Whether a Hard-to-Start Compressor Or an Easy-to-Start Blower

A Century MOTOR with the Correct Functional Characteristics is Available



Type SC, 7½ HP Century two-speed induction motor driving a blower in a fruit sterilizing plant.

For any application in refrigeration, air conditioning, heating and ventilating there is a Century motor that exactly meets the requirements of the power-driven equipment.

Century Squirrel Cage, normal starting torque, polyphase induction motors easily meet the requirements for fans and blowers with smooth, quiet power.

Century type SCH polyphase induction motors supply the high starting torque necessary to start reciprocating compressors under full load, without over-motoring the running load. With Century SCH motors often a size smaller can be used than is necessary with a normal starting torque squirrel cage motor.

Every Century motor is built to provide long life and satisfactory performance. They are accurately and ruggedly constructed, have good mechanical and electrical balance and adequate ventilation.

Century builds a complete line of electric motors in a wide variety of types from 1/6 to 400 horsepower.

Specify Century motors for all your electric power requirements.

Popular types and standard ratings are generally available from factory and branch office stocks.

Century C MOTORS

CENTURY ELECTRIC COMPANY

1806 Pine Street • Saint Louis 3, Missouri

Offices and Stock Points in Principal Cities

596

POSITIVE

AIRFLOW CONTROL

AEROFUSE DAMPER

At the vital point of air delivery you measure the real efficiency of an air conditioning system. And, of course, the selection of air distribution equipment largely determines performance.

Take our *improved* Aerofuse Multi-Louvre Damper, for example. Balanced system assured by minute adjustment of air volume . . . convenient to regulate. Multi-Louvre construction divides supply stream, gives uniform distribution over entire outlet . . . and with minimum turbulence in air stream, quiet operation. In open position, damper provides effective area greater than that of corresponding size diffuser . . . closed, it assures complete shut-off. Tamperproof, louvres can be positively locked in any position . . . or, if desired, operator handle and rod may be removed to maintain established setting.

These are *exclusive* T & B designed-in features. As a result, when you specify Aerofuse ceiling diffusers—equipped with the Damper—for installation at the distribution end of air conditioning systems, you can be *sure* of effective, efficient control...the proper amount of supply air, delivered as you want it, where you want it, evenly distributed and without drafts.

THIS COUPON . . . Will bring you complete details and engineering data on the improved Aerofuse Damper. Mail it today!

Rush me complete information on the Aerofuse Damper.

NAME

COMPANY

ST. & NO. CITY ZONE STATE

a development of

TUTTLE & BAILEY

NEW BRITAIN, CONNECTICUT

now... FULL Modulating Weatherstat Control!

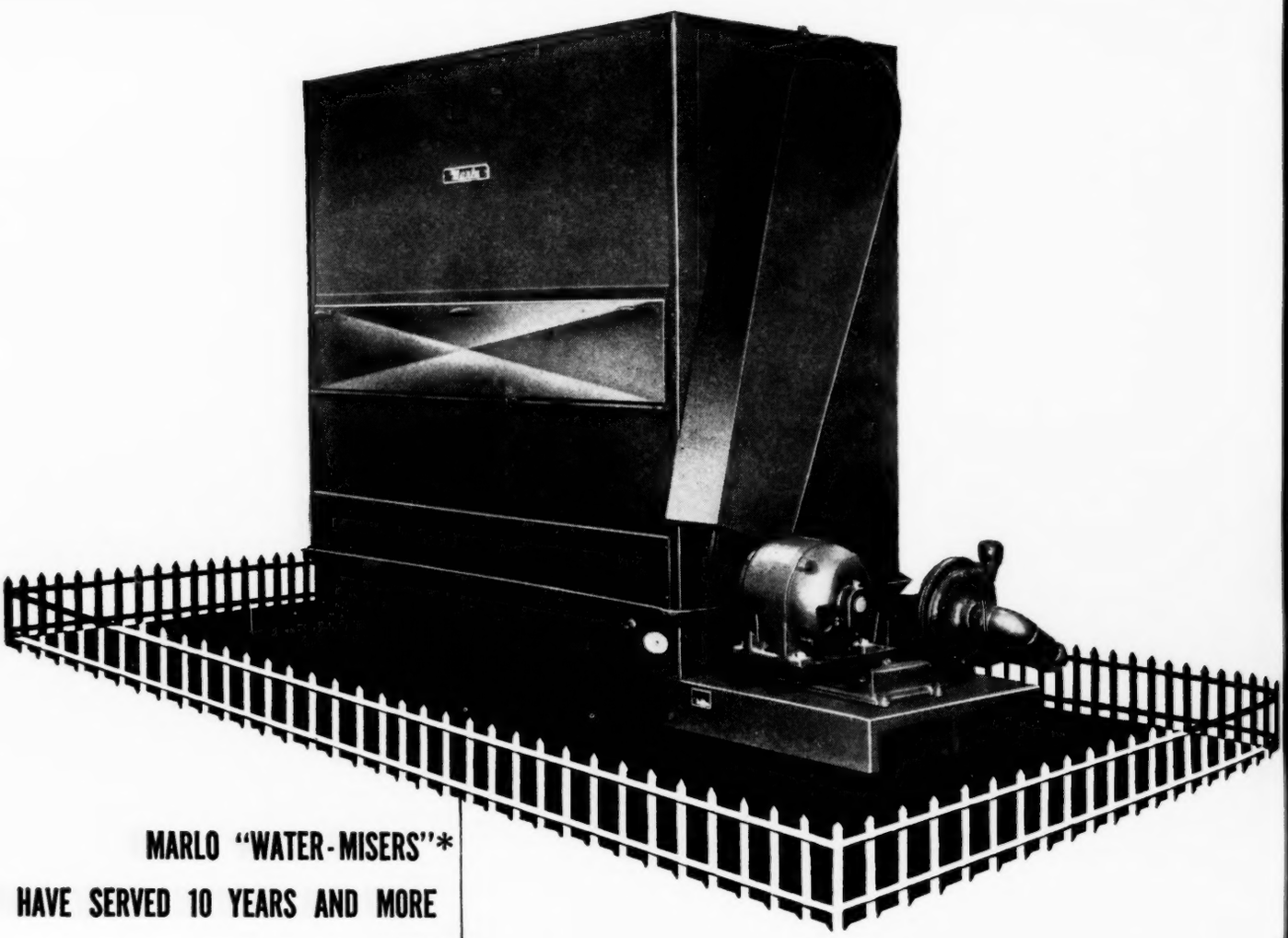
WITH the addition of the new Full Modulating Weatherstat for either hot water or steam heating plants, Honeywell now offers a complete line of outdoor control systems. All the features of other types of Weatherstat control are included in the new modulating system, plus the advantage of a continuous flow of heat modulated to furnish just the amount needed. Orifices provide for accurate balance within the building or zone.

Second of Honeywell's outdoor systems is Weatherstat Two-Position Zone Control which is used for applications with two or more zones or buildings supplied with district steam. Weatherstat Direct Control, the third System, is designed for small commercial buildings, apartment houses and similar structures which do not require zoning.

Remember, only Weatherstat control takes into account all four factors affecting heat losses—outside temperature, wind velocity, wind direction and solar radiation. With a Weatherstat system, overheating on sunny days and underheating on windy days is eliminated. Building temperatures are economically maintained at an even level during all outside weather conditions. Get the facts now about all three Weatherstat systems. Write Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Toronto 17, Ontario.

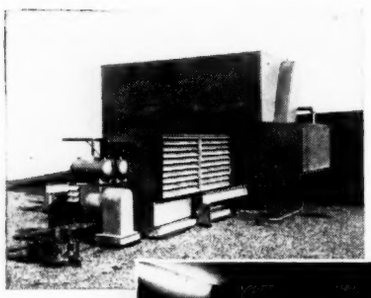
MINNEAPOLIS **Honeywell**
CONTROL SYSTEMS

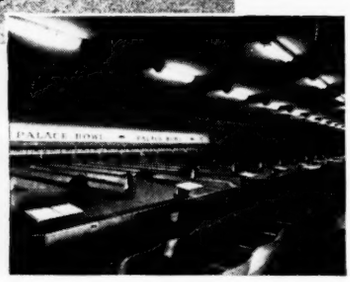
BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY



MARLO "WATER-MISERS"*
HAVE SERVED 10 YEARS AND MORE
. . . BECAUSE

MARLO SEALS CORROSION OUT!





This 100-ton Marlo EC-100 Evaporative Condenser with multiple-circuit coil, installed on the roof of the Palace Bowl, 4925 Southwest Ave., St. Louis, handles the entire air conditioning system for the huge 24-lane bowling alley, adjoining restaurant and cocktail lounge.

Sump tank, base, frame, wheels and scrolls of every Marlo Cooling Tower and Evaporative Condenser are hot dip galvanized. As added protection, the hot dip galvanized scrolls and all panels are also coated with asphalt-asbestos mastic.

The sturdy, simple construction of these quality units gives them the stamina to go on saving up to 95% of normal water costs and consumption *year after year after year.*

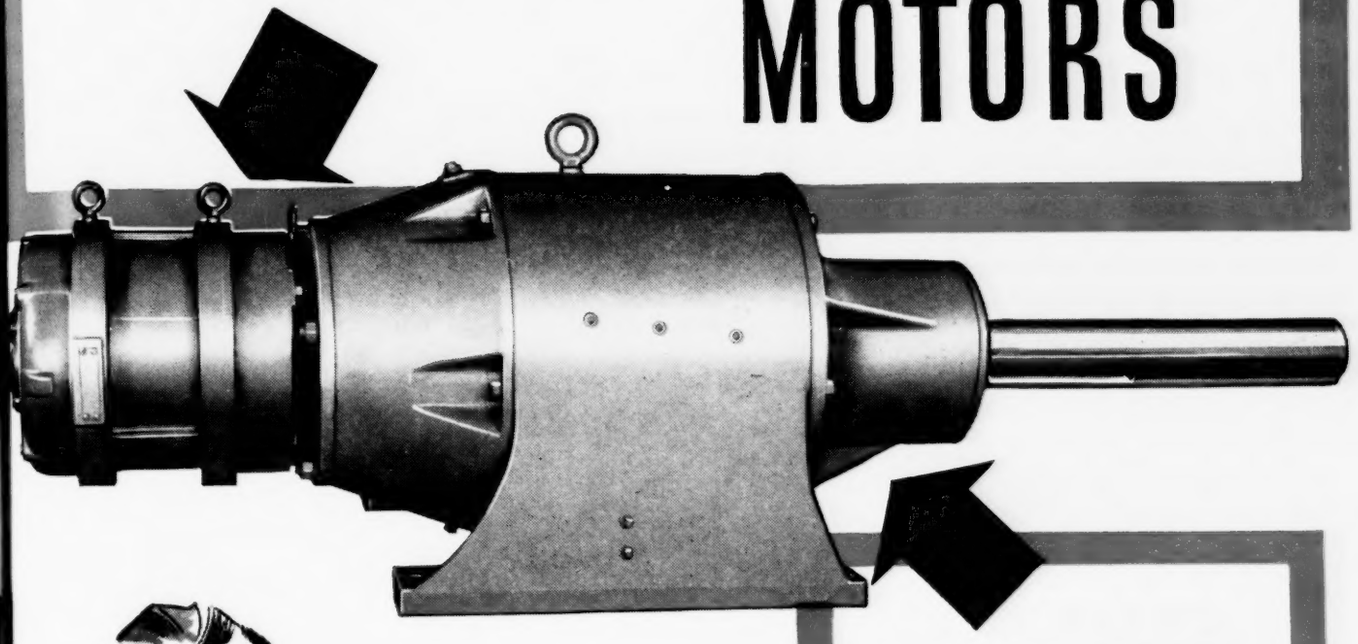
For *lasting* economy specify . . .

*MARLO COOLING TOWERS and EVAPORATIVE CONDENSERS

MARLO HEAT TRANSFER
Since 1925

MARLO COIL CO. / ST. LOUIS 10, MO.

HOWELL *industrial type* MOTORS



Here's a reliable gear-motor combination you'll want to look into.

D. O. JAMES GEAR REDUCER

Why?

Because the motor is an industrial type motor built by Howell and backed by 33 years' experience in building industrial type motors exclusively.

The gear reducer is built by the D. O. James Manufacturing Company, specialists in their field with more than 50 years' experience.

The combination makes an integral packaged unit with the motor flange-mounted to the reducer, yet with a flexible coupling so that motor and reducer can readily be separated for maintenance.

For a modern, economical means of obtaining relatively low speeds from constant speed motors in your business, be sure—buy Howell!

RED BAND MOTORS
HOWELL
SINCE 1915

For geared motors, motors with unique electrical characteristics, special mechanical form, or standard motors (with any type of enclosure) from 1/6 through 150 HP, consult your HOWELL representative.

HOWELL ELECTRIC MOTORS CO., HOWELL, MICHIGAN

MANUFACTURERS OF PRECISION BUILT, INDUSTRIAL TYPE MOTORS

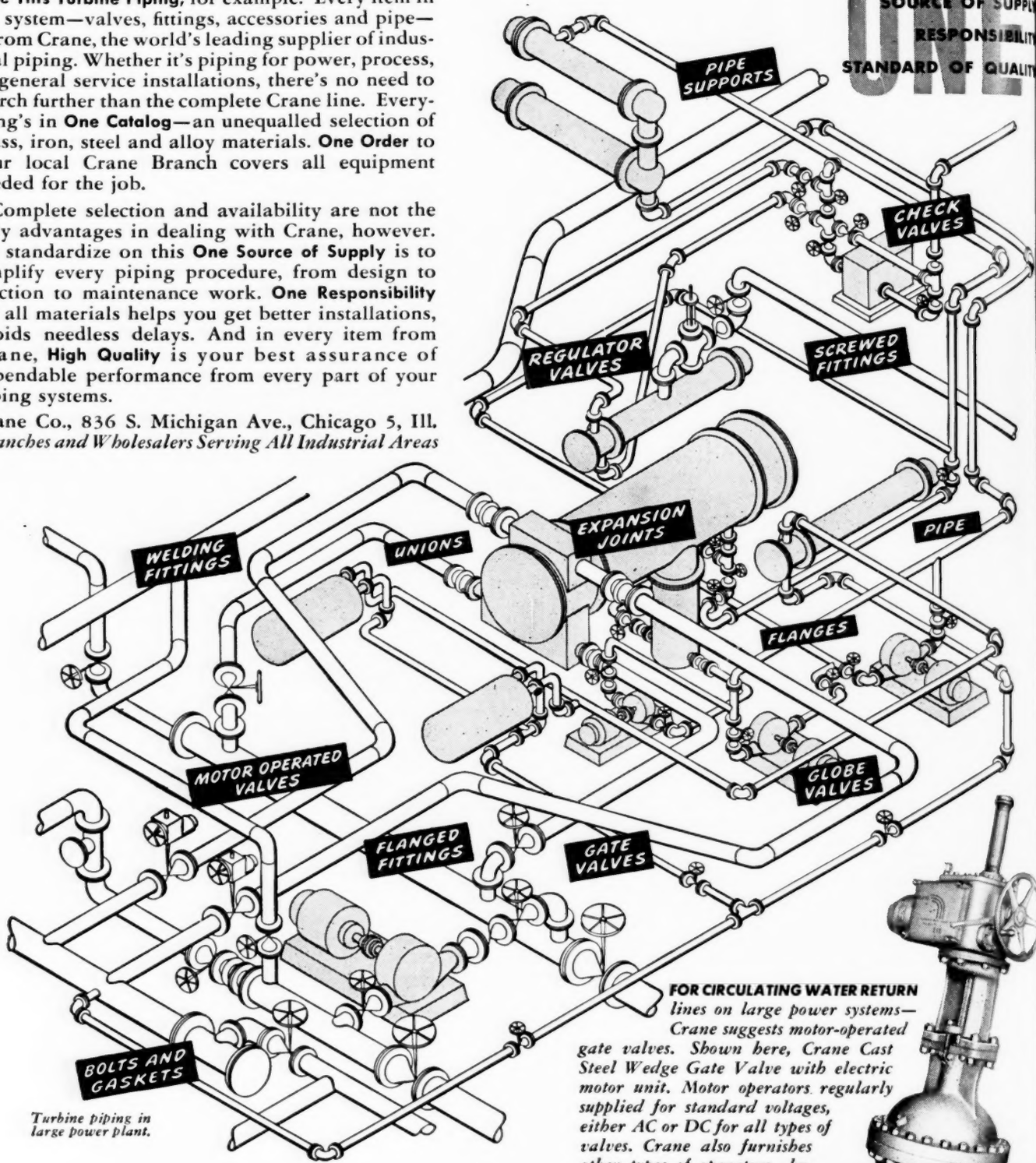
Everything in power piping ...on One Order to Crane

Take This Turbine Piping, for example. Every item in the system—valves, fittings, accessories and pipe—is from Crane, the world's leading supplier of industrial piping. Whether it's piping for power, process, or general service installations, there's no need to search further than the complete Crane line. Everything's in **One Catalog**—an unequalled selection of brass, iron, steel and alloy materials. **One Order** to your local Crane Branch covers all equipment needed for the job.

Complete selection and availability are not the only advantages in dealing with Crane, however. To standardize on this **One Source of Supply** is to simplify every piping procedure, from design to erection to maintenance work. **One Responsibility** for all materials helps you get better installations, avoids needless delays. And in every item from Crane, **High Quality** is your best assurance of dependable performance from every part of your piping systems.

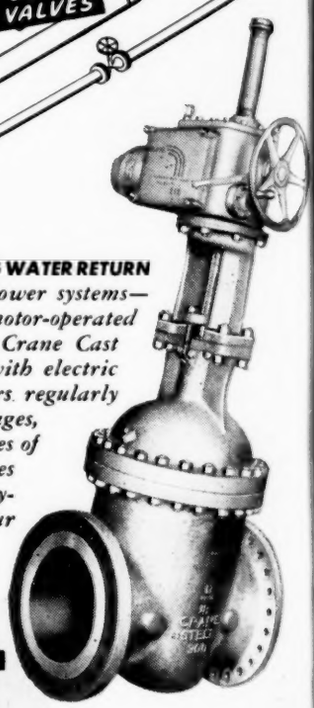
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Turbine piping in large power plant.

FOR CIRCULATING WATER RETURN *lines on large power systems—Crane suggests motor-operated gate valves. Shown here, Crane Cast Steel Wedge Gate Valve with electric motor unit. Motor operators regularly supplied for standard voltages, either AC or DC for all types of valves. Crane also furnishes other types of operators—hydraulic, air, etc. See your Crane Catalog.*



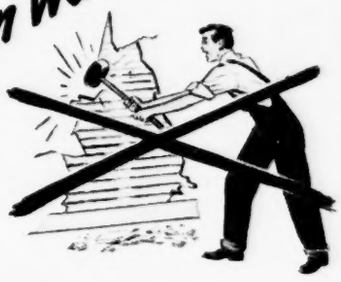
EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

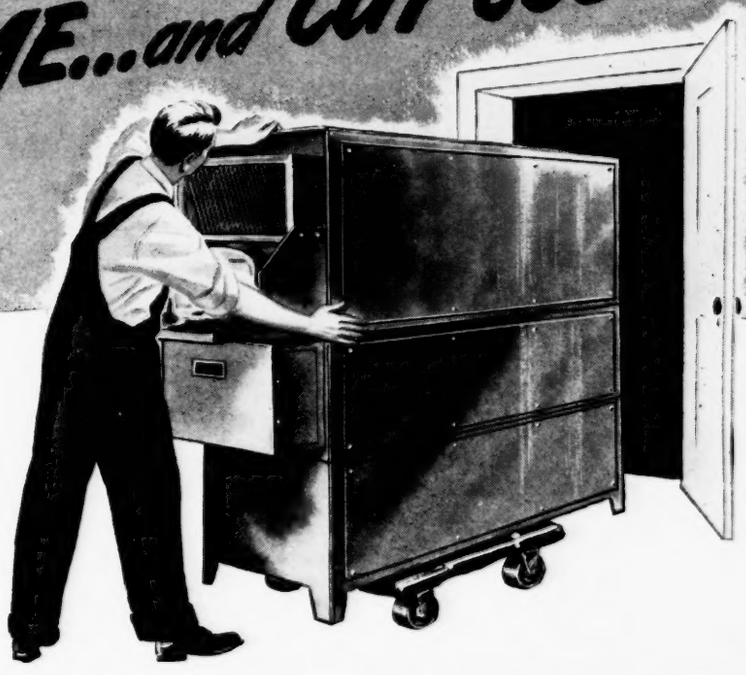
FOR EVERY PIPING SYSTEM

DON'T knock down walls



DON'T waste time with small parts

DO SAVE INSTALLATION TIME...and CUT COSTS



...with G-E Central Plant Air Conditioners

ALL sections of the new General Electric Central Plant Air Conditioners can pass easily through a standard 30″ door . . . the two smallest models completely assembled. This compactness allows a wide choice of location for the unit. It means time and money saved in installation, too.

28 different arrangements

Both vertical and horizontal models are designed on the building block principle—12 different vertical arrangments—16 horizontal arrangements. They cover a cooling range from .8 to 58 tons . . . and a heating range from 28,100 to 1,310,000 Btu's per hour.

All units are pre-fabricated, pre-engineered and pre-matched to assure fast assembly if shipped in sections. The welded sheet-steel construction is rigid, light in weight, making it easy to handle, inexpensive to ship.

For a smoother, quicker, less expensive air conditioning job, get full information from your local G-E air conditioning representative today. Or fill in coupon below.

GENERAL ELECTRIC

Better Air Conditioning

General Electric Co.
Air Conditioning Dept., Sect. A89111
Bloomfield, N. J.

Gentlemen: Please send me your new booklet on the new G-E Central Plant Air Conditioners.

Name.....

Address.....

City.....State.....

—*for the great hotels of the world*

Forty-seven floors of luxury, occupying an entire city block, the famous Waldorf-Astoria has no equal in the hotel world! Into the building of this dream hostelry went the finest architectural and engineering experience in the land . . . and the most modern and appropriate materials and equipment that money could command.

The Waldorf-Astoria's great labyrinth of *steel piping,* for the heating lines, soil, waste and vent lines, fire, air conditioning, and vacuum lines, can be measured in terms of hundreds of miles and thousands of tons!

For such vital services, *steel pipe is the first choice* of technical men who judge the qualifications of every material and product in terms of adaptability, serviceability, durability, and cost. These qualities of *steel pipe* which made it the predominant choice for this cathedral of comfort are the same qualities that have made it the predominant choice for all types of buildings the country over.

Yes, *steel pipe is first choice!*

The interesting story of "Pipe in American Life" will be sent upon request.

COMMITTEE ON STEEL PIPE RESEARCH
OF AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Ave., New York, N. Y.

BRUNNER
SINCE 1906

REFRIGERATION helps you serve better

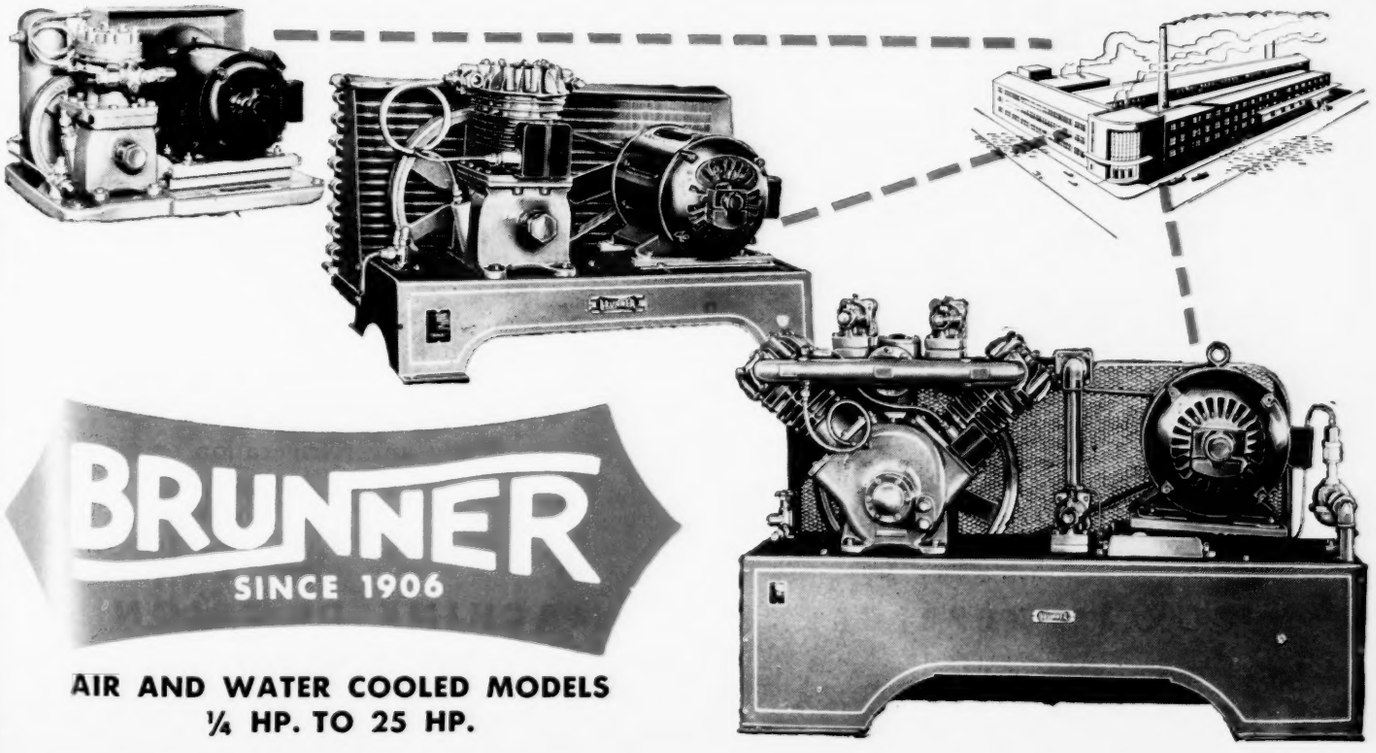
Memo to Contractors

CONDENSING UNITS ARE MOST INTERESTING

Guess we say condensing units are *most* interesting because they look so much alike but are so very different in service...there are so many angles to be considered and checked.

The important point is just this: the entire success of an air conditioning or other refrigeration installation stems from the condensing unit. That unit must be selected on the basis of in-service facts on dependability, long life, minimum maintenance. Your business depends upon your judgment in selection. Brunner condensing units throughout the world; Brunner representatives who live near you and talk your language; expanded plant facilities for quick delivery; are the *sure* answers to all your questions. Write us about the job you have in mind.

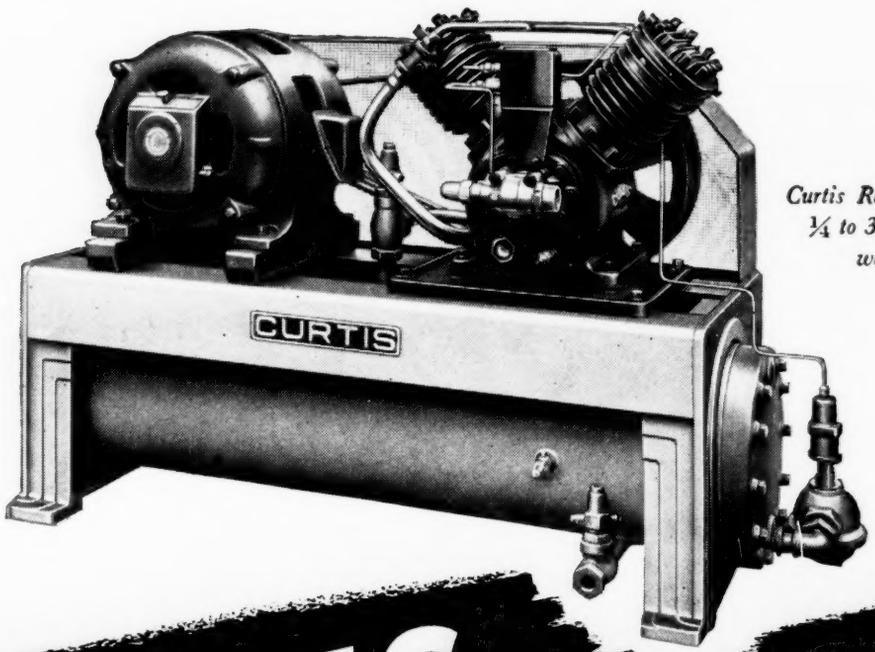
BRUNNER MANUFACTURING CO.
UTICA 1, NEW YORK, U. S. A.



BRUNNER
SINCE 1906

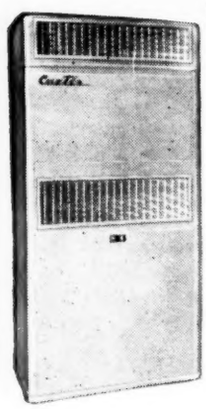
AIR AND WATER COOLED MODELS
¼ HP. TO 25 HP.

Built for High Efficiency • Low-cost Operation



Curtis Refrigeration Units, ¼ to 30 H.P., air and water cooled.

CURTIS
COMMERCIAL REFRIGERATION AND AIR CONDITIONING EQUIPMENT



Curtis Self-Contained Air Conditioners—3, 5, 7½, 10 and 15 tons.

Whatever the application in commercial refrigeration or air conditioning, the Curtis nameplate is your assurance of top quality construction, sound, proven engineering principles and low maintenance and operating expense. Just a few of the many features include:

- Timken Bearings
- A wide range of types and sizes
- Extra large condensers
- Positive-pressure lubrication
- Quiet operation
- Slow speeds — long life

Write for full information on the Curtis line of equipment for practically any refrigeration or air conditioning requirement.

CURTIS REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
1999 Kienlen Avenue, St. Louis 20, Missouri AB-583

94 Years of Precision Manufacturing

---on cutting fuel bills in Half

During New England's severe winter of 1947-8, the J. C. Corrigan Company, Inc., of Dorchester, Mass., *cut its fuel bill nearly 50%* by installing a DRAVO *Counterflo* Heater. Coal for the previous winter season had cost this company between $1100.00 and $1200.00, whereas only $652.00 was spent for oil to fuel the DRAVO Heater during a similar period.

Besides fuel savings, the maintenance expense for the old heating system was practically eliminated because the DRAVO Heater operates automatically by thermostatic control. "Even more important" says J. C. Corrigan, President, ". . . part of our substantial increase in production this winter was due to the improved heating system."

Employees in the Corrigan plant manufacture custom-built conveying systems and need adequate warmth for efficient fitting and assembling. Previously, the plant was heated by a coal burning furnace using blowers and ductwork to distribute the warm air. Excessive roof heat losses in this 165' x 70' x 27' building, prevented it from being comfortable. To heat "cold spots" that developed, eight pot-bellied stoves were installed. Maintenance of this old heating method required three hours labor every day. Coal and ashes had to be hauled through the heart of the busy plant. Even with the eight stoves to supplement the coal-fired furnace, heat was inadequate and employees spent valuable production time huddling around the stoves.

In November 1947, one DRAVO *Counterflo* Heater with an output capacity of 2,000,000 Btu was installed. No ductwork was needed. Only fuel and power lines had to be connected and a vent stack installed. Now the entire factory area is maintained at the proper degree of warmth for workers' comfort and efficient production. During sub-zero weather last winter, the single DRAVO Heater delivered enough heat within 20 minutes after it was turned on to satisfy the thermostat's setting. Moreover, the DRAVO Heater is shut down to conserve fuel during non-working hours, whereas the coal furnace had to be fed over week-ends while the plant was not in operation to maintain some warmth for the Monday morning shift.

DRAVO *Counterflo* Heaters burn oil, gas or coal. Units burning non-solid fuels can be converted from one fuel to another very readily. Coal-fired heaters can be converted for burning gas or oil.

You may also have a problem like Corrigan's—or one more complex. Write us for information and the name of our nearest representative. DRAVO CORPORATION, *Heating Section*, Dravo Bldg., Fifth and Liberty Avenues, Pittsburgh 22, Pa.

DRAVO
CORPORATION

DRAVO

Pittsburgh • Cleveland • Philadelphia • Detroit
New York • Chicago • Atlanta • Boston
Sales Representatives in Principal Cities

5 FUNCTION HEATING
with JUST ONE UNIT!

DRAVO CORPORATION, Heating Section, Room 812-11
2 Dravo Bldg., Fifth and Liberty Avenues, Pittsburgh 22, Pa.
We would like to consider DRAVO *Counterflo* Heaters for:

Name..... ☐ Comfort Heating
Title..... ☐ Year 'round Ventilating
Company..... ☐ Process Drying
Address..... ☐ Tempering Make-up Air
City and State..... ☐ Heat Curing

P-6301

Will this winter mean this to you again?

Experts agree the shortages of some fuels will last from 3 to 5 years

Regardless of Your Heating or Power requirements Anthracite is the ideal fuel!

• The supply of hard coal is ample. Hard coal equipment is available to supply heat and power to every building type . . . efficiently and without fuel worries.

Everyone can be satisfied because anthracite offers you these seven advantages:

1. Elimination of your supply problem. Anthracite is plentiful.

2. No need for capital investment in special smoke abatement equipment . . . hard coal is smokeless and sootless.

3. Anthracite is an inexpensive fuel . . . and stokers use the smaller, cheaper sizes.

4. Safe storage without degradation even in large amounts.

5. Savings on labor . . . high efficiency with automatic anthracite equipment.

6. No fire hazards from explosion or spontaneous combustion.

7. Plenty of service hot water—in any desired quantity—supplied efficiently and economically.

Get all the facts on heating with all types of anthracite equipment including modern automatic stokers. Simply mail the coupon today.

ANTHRACITE INSTITUTE

101 Park Avenue • New York 17, New York

ANTHRACITE INSTITUTE
101 Park Ave., Dept. 11I, New York 17, N. Y.
Please send me more information on anthracite and anthracite equipment.

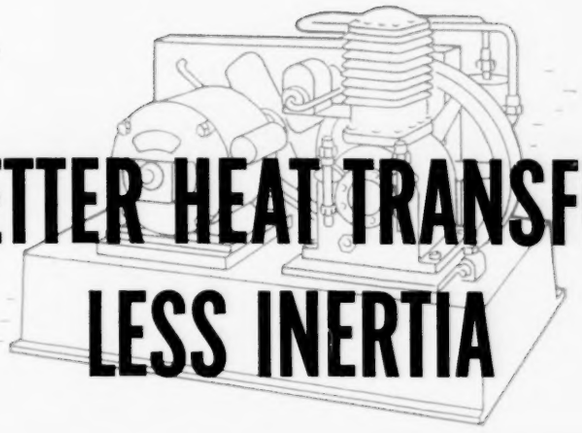
Name_____

Company_____

Address_____

City_____ Zone____ State_____

PLEASE PRINT



BETTER HEAT TRANSFER LESS INERTIA

. . . AND THE LOW COST WILL SURPRISE YOU!

Heat travels fast through aluminum. Cast aluminum cylinder heads, pistons, and other parts help make compressors and pumps work at higher efficiency.

Reciprocating parts run smoother with less wear because of aluminum's light weight . . only 38% as heavy as iron.

As-cast surfaces of aluminum castings are smooth and sound. Where machining is required, you can run tools faster. Even large castings are generally light enough to be *hand*-lifted through production lines. Painting isn't required for most applications.

The cost of Alcoa Aluminum Castings? Much lower than you'd imagine . . . for some types of work they're competitive with heavy metals. Deliveries are prompt from Alcoa's 8 modern foundries.

Your local Alcoa Sales Office will gladly quote on your casting requirements. ALUMINUM COMPANY OF AMERICA, 1471 Gulf Bldg., Pittsburgh 19, Penna.

ALCOA FOUNDRIES AT BRIDGEPORT, CLEVELAND, DETROIT, LOS ANGELES

ALUMINUM CASTINGS by ALCOA®

PROGRESS
ON PARADE *at the...*

Under Auspices of American Society of Heating and Ventilating Engineers

Striking advances in equipment . . . the latest trends and practices—newest and best ways to heat, ventilate and air condition all types of industrial plants, and commercial and public buildings—a wealth of practical, profitable ideas—are all in store for you here. Greatest display of its kind ever assembled, its informative, technically-staffed exhibits and demonstrations will afford unequalled opportunity to see and compare at one time hundreds of new and improved items from complete units to maintenance supplies—to discuss your plans, problems and requirements first-hand with engineering specialists.

Because of today's rapid advances in your important fields of activity, you and your associates cannot afford to miss this outstanding display of progress. Plan now to attend—note the date.

Management International Exposition Company

Pennsylvania builder uses CHASE COPPER TUBE RADIANT HEATING in 185 homes!

At Chester, Pa., F. A. Collins has erected 185 one-story, 6-room cellarless homes with Chase Copper Tube Radiant Heating. Wilson Bros., Collingdale, Pa., Heating Contractors.

HERE'S WHY

you, too, will want Chase copper tube in your Radiant Heating Installations!

- EASY TO BEND
- LIGHT IN WEIGHT
- SOLDERED FITTINGS
- SMALL DIAMETERS
- LONG LENGTHS
- LOW COST
- LONG LIFE

CHASE

ONE advantage of Chase Copper Tube for radiant heating is the fact that no special bending tools are needed for installation. Flexible and small in diameter, it's easily bent by hand. It comes in long lengths of 60′ and 100′ requiring fewer joints. For ceiling installations, the light weight and smaller outside diameter of Chase Copper Tube is ideal. It can be installed in the standard ¾" ceiling plaster coat.

These facts, and the many other advantages listed in the panel on the right, are the reasons why builders of low-cost housing as well as builders of expensive homes turn to Chase Copper Tube for radiant heating installations.

SEND FOR *FREE* BOOKLET!

For Radiant Heating information, cut and mail coupon today. Illustrated literature will be forwarded to you promptly.

MAIL THIS COUPON TODAY

Chase Brass & Copper Co., Dept. HV118
Waterbury 91, Conn.

Gentlemen: Please forward your new booklet "Suggestions For Designing Radiant Panel Heating with Copper Tube."

Name_____

Address_____

City_____ State_____

Chase

the Nation's Headquarters for
BRASS & COPPER

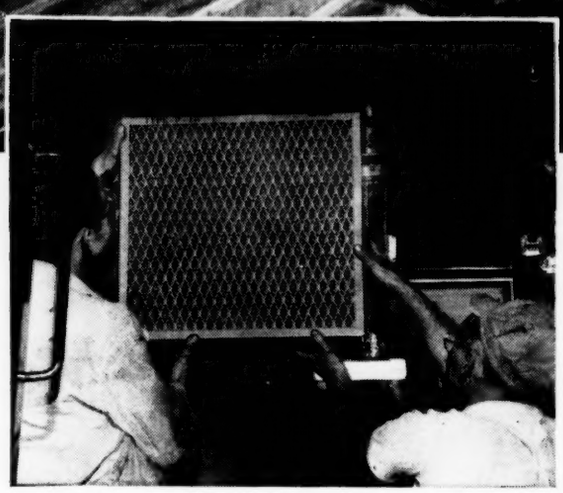
WATERBURY 91, CONNECTICUT

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WATERBURY (†indicates Sales Office Only)

New York Central's new 20th Century Limited is equipped with Air-Maze Filters



Installing Air-Maze filter on new 20th Century Limited passenger car under construction at the Pullman Standard factory.

NEW YORK CENTRAL provides extra comfort for passengers in their new 20th Century Limited by using Air-Maze air filters to rid the air of dust, lint and dirt.

This progressive railroad is but one of many that specifies Air-Maze air filters as standard equipment. Leading hotels, office buildings and factories as well use Air-Maze filters in their ventilating systems. If you'd like the best answer to *your* filtration problems, follow their lead and call in Air-Maze—the filter engineers. Write Air-Maze Corporation, Cleveland 5, Ohio.

EACH TYPE OF AIR-MAZE FILTER IS DESIGNED FOR A SPECIFIC PURPOSE

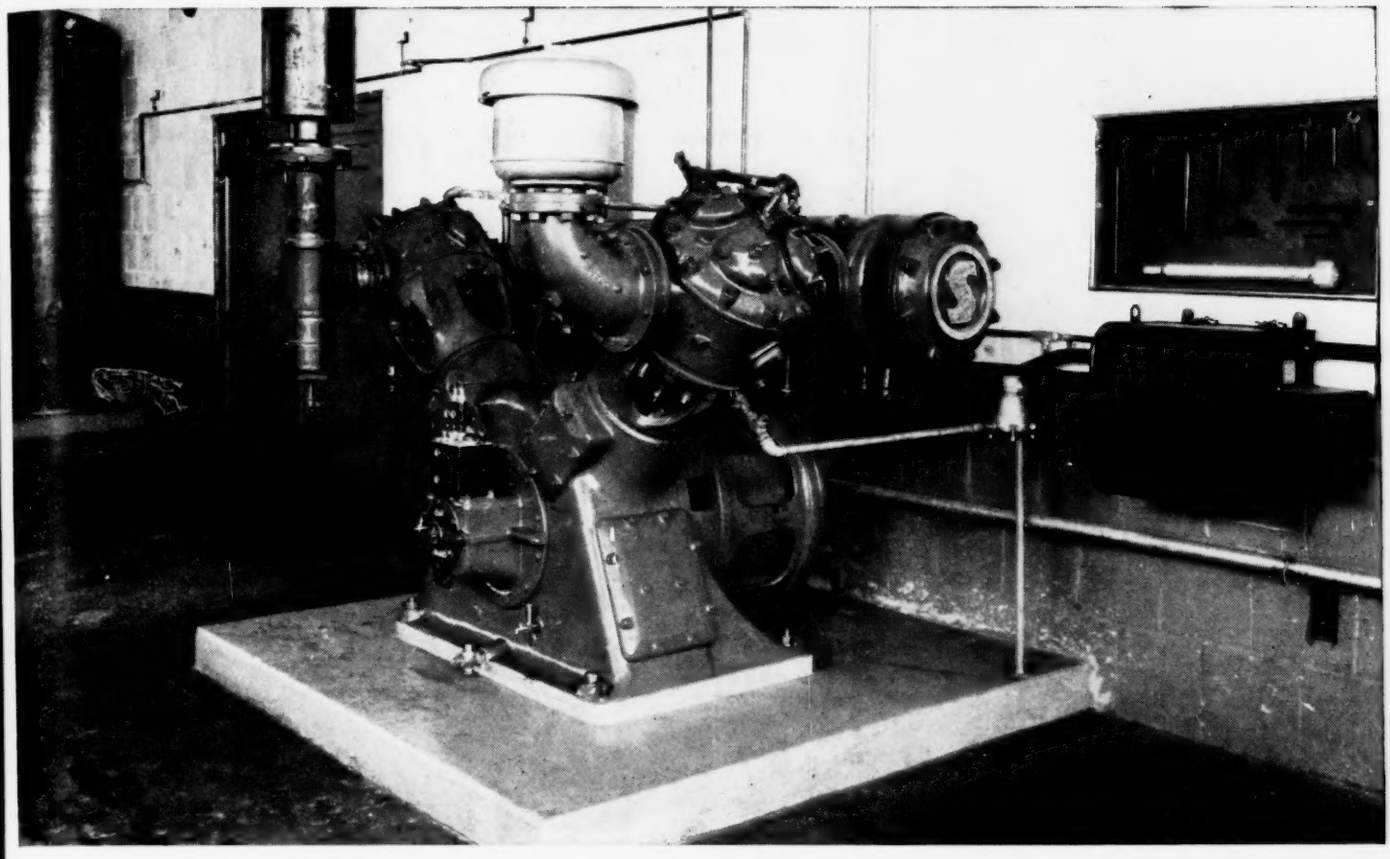
Air-Maze engineers have designed—not one—but *many* types of all-metal, cleanable impingement filters for various ventilating applications. Each type has a proved record of field performance to justify its place in the ventilating industry.

There is no *one* filter that meets *all* the requirements of the ventilating engineer. But the chances are there is a particular Air-Maze filter *engineered* to handle your specific ventilating job.

AIR-MAZE

THE FILTER ENGINEERS

AIR FILTERS • SILENCERS • SPARK ARRESTERS • LIQUID FILTERS
OIL SEPARATORS • GREASE FILTERS



Here's top efficiency in the 400 to 1800 c.f.m. range!

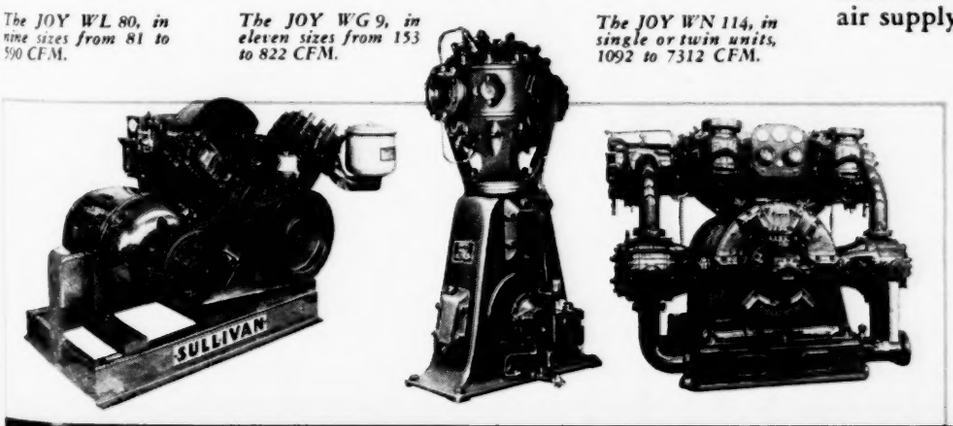
The JOY WN-112 AIR COMPRESSOR

Built in sizes from 378 to 1828 CFM, the JOY WN-112 is a two-cylinder, two-stage, heavy-duty compressor with the exclusive JOY "Dual-Cushion" valves for top efficiency. Compact and highly modern, it saves space and cuts installation costs. ● JOY builds the most modern compressors available for either centralized or de-centralized air supply—*write for Bulletin.*

The JOY WL 80, in nine sizes from 81 to 590 CFM.

The JOY WG 9, in eleven sizes from 153 to 822 CFM.

The JOY WN 114, in single or twin units, 1092 to 7312 CFM.



Consult a Joy Engineer

W&D 12055

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY-SULLIVAN OF CANADA, LIMITED, GALT, ONTARIO

One of a series *of messages to help you increase your understanding of business paper advertising, and its effect on your job.*

No matter what you make —you're not making it at a profit !

You may have the finest product of its kind. Your production set-up may be a miracle of efficiency. Perhaps you've even discovered how to cut your cost-per-unit below that of your closest competition. The fact remains —

You're still not *making* anything at a profit. Because actually, of course, there is no such thing.

Goods can only be *sold* at a profit. And selling them profitably requires the same kind of mechanization that keeps your production costs down.

In the *manufacture of a sale*, for example, there are five basic operations —

1. **Seeking out prospects**
2. **Arousing their interest**
3. **Creating a preference for your product**
4. **Making a specific proposal**
5. **Closing the order**

Any good salesman can handle all five. But no salesman should *have* to — not when the first three can be mechanized so economically through the use of advertising.

For good advertising, like the machine on your production line, is a multiplier of individual effort, enabling all of us to produce (and *earn*) far more than we could alone.

And when it goes to work in *business papers* — with their tremendous concentration of hand-picked prospects — advertising becomes the most efficient machine available for manufacturing sales at a profit!

HEATING AND VENTILATING

is a member of The Associated Business Papers, who have published an interesting folder entitled, "10 ways to measure advertising effectiveness." We'll be glad to send you a copy. And if you'd like reprints of this advertisement (or the entire series) to pass along to others in your organization, just say the word.

at NO EXTRA COST

The new quick-opening set-lock assembly on the Kno-Draft Air Diffusers

Cuts installation and maintenance time

Instant Cleaning and Inspection:

With the new quick-opening Type HD set-lock assembly, the inner element of the Kno-Draft Adjustable Air Diffusers can be quickly removed and reinstalled while the diffuser is in place without affecting its adjustment.

It takes but a minute—requires no tools

The "B" cone or inner element of the diffuser is secured to the combined suspension and adjustment screws by a springloaded catch which is kept in compression by a slotted washer. The holes in "B" cone pass over the bolt heads. All you do is press up on cone "B" and insert or remove the slotted washers.

Nation-wide sales and engineering service

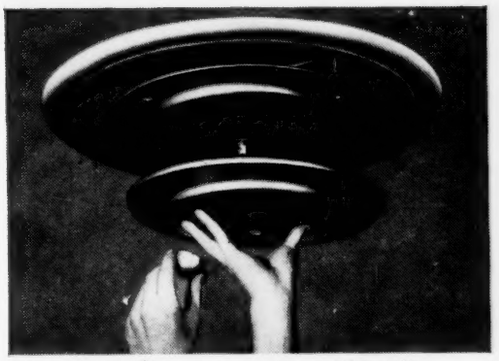
The W. B. Connor Engineering Corp. maintains a research laboratory with a staff of trained specialists and district representatives in leading cities. Their services are at the disposal of consulting engineers, architects, air conditioning dealers and plant engineers. They can assist you in getting the best possible performance from your air conditioning system by creating custom-made air patterns which will thoroughly mix room and supply air, eliminate drafts and maintain uniform temperature throughout an area.

W. B. CONNOR ENGINEERING CORP.

Air Diffusion • Air Purification • Air Recovery

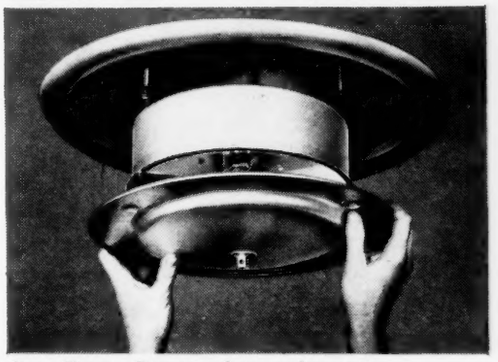
112 East 32nd Street CONNOR New York 16, N. Y.

IN CANADA: Douglas Engineering Co., Ltd., 100 Murray Street, Montreal 3, P. Q.

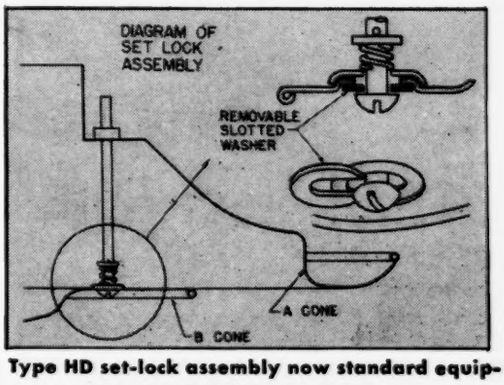


Step One: Remove cover cone (if used)

Step Two: Press "B" cone—slip out washers



Step Three: Remove inner element



Type HD set-lock assembly now standard equipment on Kno-Draft Adjustable Diffusers

FREE HELPFUL LITERATURE

☐ **Bulletin K-21:** Contains complete details on the new, exclusive Kno-Draft Type HD Set-Lock Assembly.

☐ **New handbook on air diffusion:** Contains all the engineering data necessary on air diffusion in general and Kno-Draft Adjustable Diffusers in particular to enable you to create "custom-made" air patterns and eliminate drafts.

W. B. Connor Engineering Corp.
Dept. E-107, 112 East 32nd Street
New York 16, New York

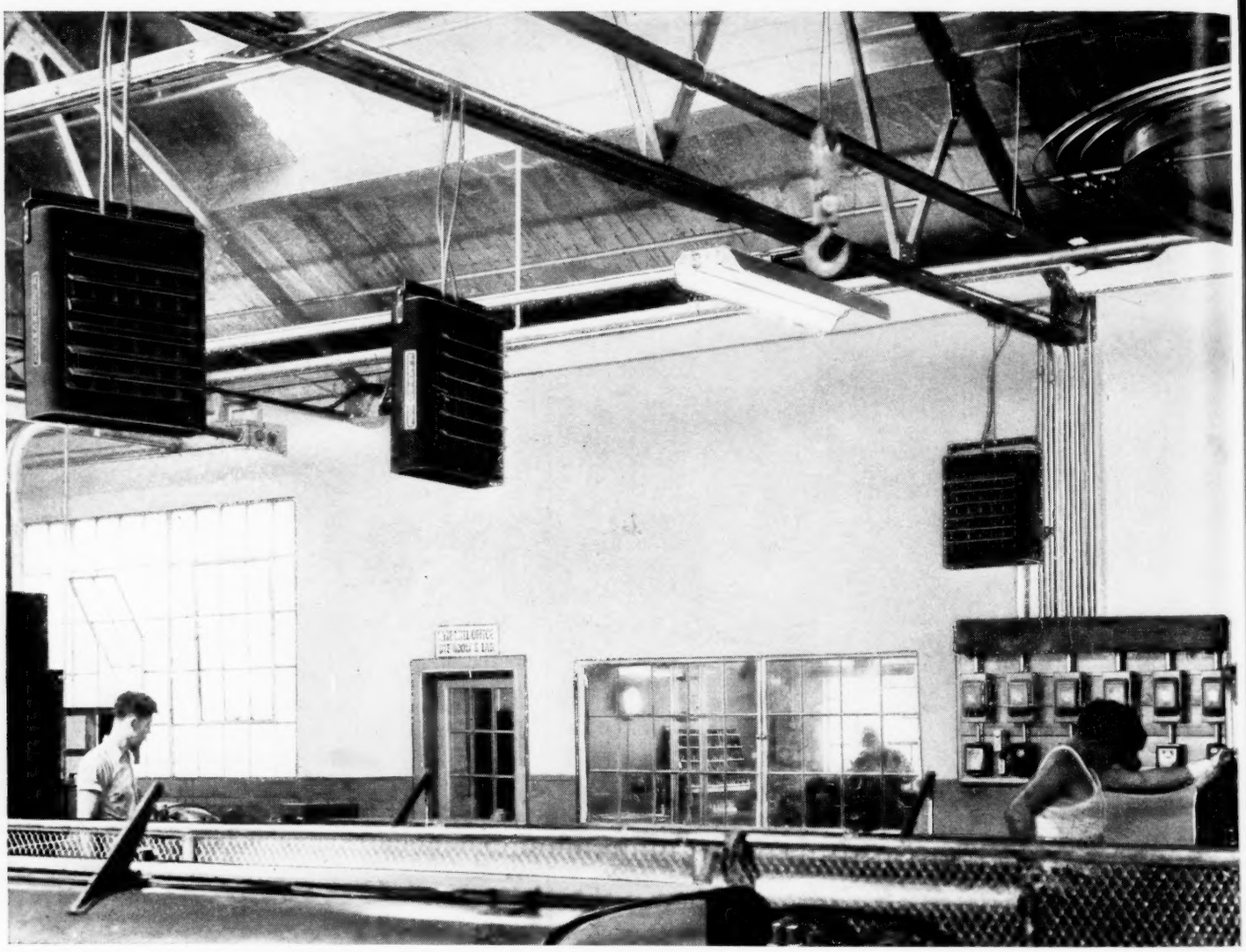
Please send me the free literature I have checked above.

Name.....

Company.....

Street.....

City..... Zone..... State.....



Illustrated: Electromode Suspension Type Heaters

Only ELECTROMODE Can Give SAFE Electric Heat Anywhere In Your Plant

ELECTROMODE Unit Heaters have no exposed hot, glowing wires; thus they may be used safely *anywhere*. The patented Safety-Grid—a heating element insulated and embedded within a finned aluminum casting—supplies abundant fan-driven warmth. As auxiliary heat sources, Electromodes pay for themselves during changeable weather . . . give quick warmth *locally* while the main heating plant is shut down or banked. They save the cost of operating boilers when only certain departments need heat.

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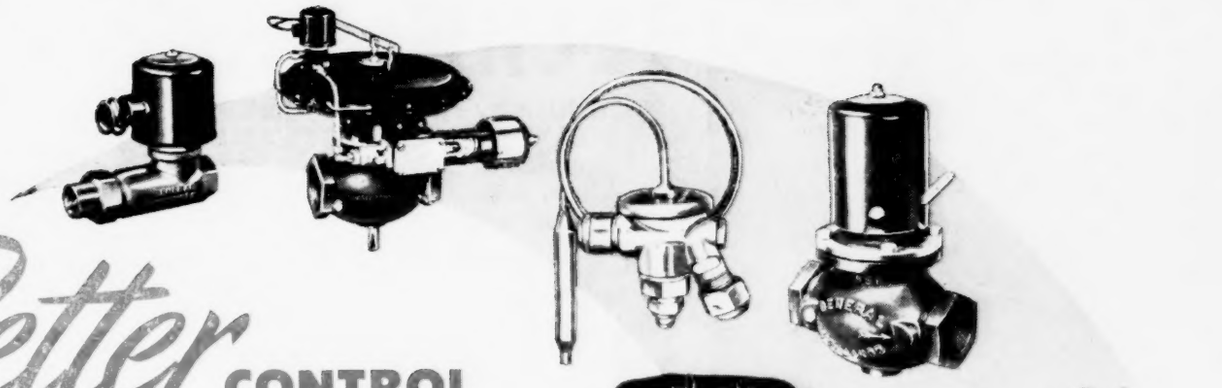

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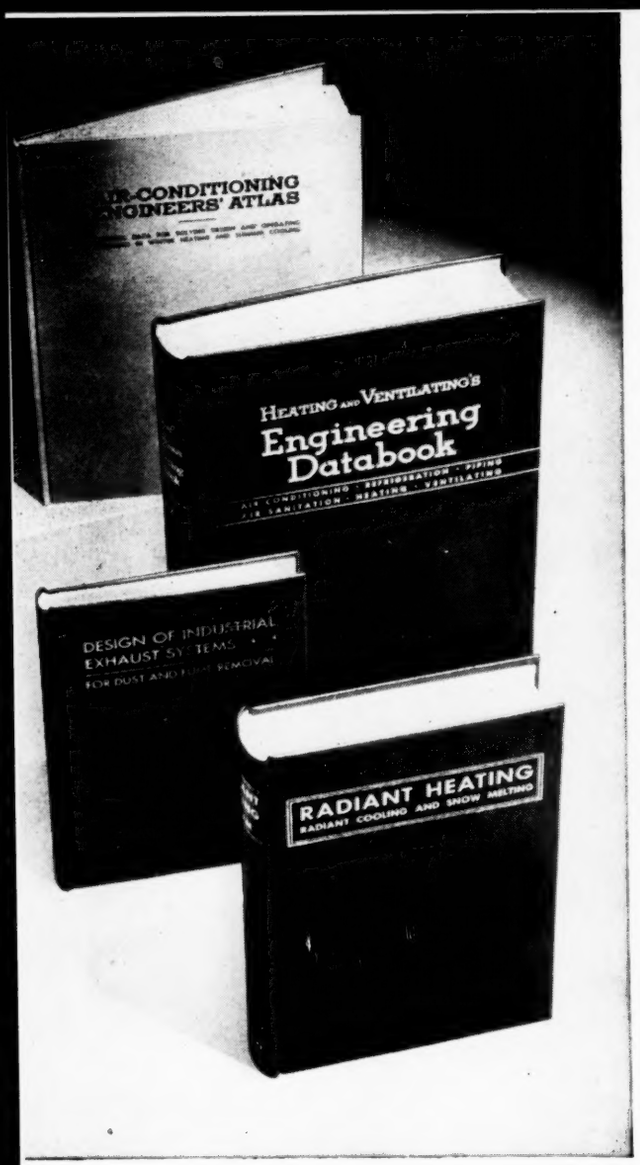

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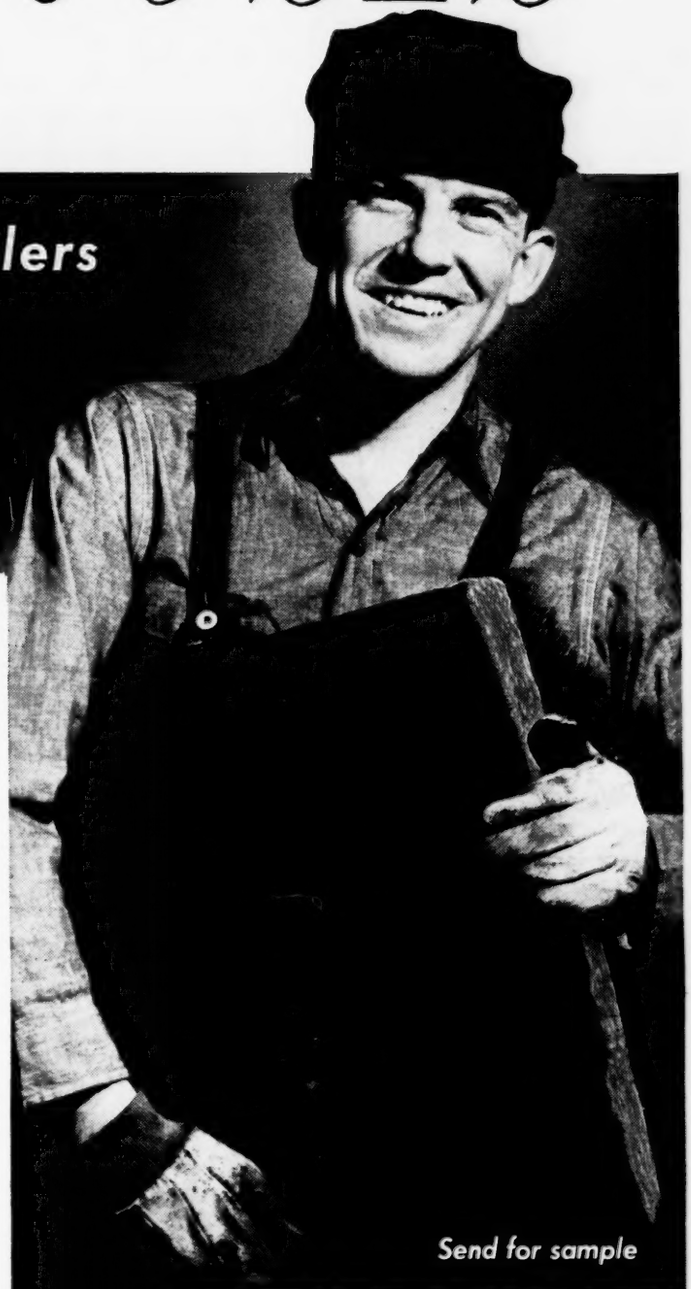

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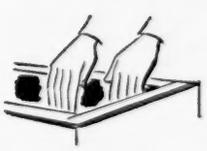

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Washington News

LORING F. OVERMAN

THE tumult and the shouting dies. But expect no hurried departure of the captains and the kings, or of their legions. Big government has become so much a part of the American scheme that a mere election will not lessen the importance of Washington's influence. Indeed, there is plenty of evidence that the Washington influence is to be even further extended.

For example, the District of Columbia's own city government has just requested an appropriation of $60 million to expand waterworks facilities, to serve an expected population of 1,090,000. Recalling that the D.C. population was 690,000 in 1947, and that it is currently around 900,000, it would appear that a lot more folks are drawing water from the community pump. Yes, Washington is planning on further growth, and as it grows, its effect on the lives of others also expands.

During the closing week of October, Washingtonians were further reassured by goings-on at the Soviet Embassy. Passersby noted that the Soviets were spending several thousands of dollars to have the exterior of their four-story building sand-blasted to like-new whiteness. Comments like the following were heard: "Guess they're going to stay," "They wouldn't be fixing the building up if they were going to bomb," and so on. Pessimists observed that it was probably a propaganda move to lull the public into thinking nothing sinister was going on. Prize pessimistic comment was, "Maybe they're fixing it up for Stalin to move in."

All in all, the general conclusion was that the Russians, like the rest of the folks in this country and abroad, have reached the conclusion that they're going to have to do business with Washington, and might as well make the best of it.

Now that's a wise decision, for as the Administration charts its course for 1949, a number of legislative possibilities will be reflected in changes in everyday living, both here and overseas. In sight are:

Increased military spending.

Continued foreign aid.

Steel allocations—probably voluntary for a while.

Military Spending

The dent that's going to be made in the supply of physical things in this country in 1949 is indicated by the estimate that defense expenditures for the year will be 18 to 19 billion dollars. Fourteen billion is the sum mentioned for our own armed forces, with the additional four to five billion suggested as about right to lend-lease or otherwise provide arms for Western European nations. There is a growing conviction at the policy level that America's best and cheapest defense lies in arming friendly allies to the teeth.

If this conviction crystallizes into Congressional action, early deliveries overseas will be made from stockpiled surplus, but the program will include replacing all materiel released on a hurry-up schedule.

Foreign Aid

The foreign aid program, via Marshall plan and ECA, is expected to draw another 5 or 6 billion dollars worth of things from the Nation's current production. Again, the type of things to be drawn will be on the heavy side, with less and less emphasis on food and soft goods. Goal of the ECA plan is to make the Western European nations as self-sufficient as possible, with equipment of their industrial machine seen as preferable to supplying their needs with American made goods.

ECA Director Paul Hoffman appears convinced that, with one or two exceptions, Western European countries are ready to play ball on the idea of putting themselves in a position to produce for their own needs, rather than merely accepting day to day handouts. The same theory will doubtless be applied to China aid, as well as to other countries which appear to be dependent upon the United States for post-war rehabilitation.

It all adds up to the fact that 1949 will again find this country short of the heavy goods it needs to bring its own economy back into balance. This will be particularly true of steel products, which cannot keep pace with demand, despite the fact that production this year promises to total 88,000,000 tons—up one-third from the prewar average of 66,000,000 tons annually. Last year's total was 85 million tons, and the wartime peak, reached in 1944, was 89 million.

Before criticizing the steel industry for not exceeding its wartime peak, it should be remembered that today's production must be fabricated to meet industrial requirements, while the wartime tonnage include large quantities in the form of armor plate and ordnance shapes for which their is no peacetime market.

Efforts of the steel industry to meet current global demand are being hampered by two things—dwindling supplies of high grade ore, and shortages of scrap. To correct the easiest-remedied of these deficiencies, a nationwide drive for scrap is being conducted by the Office of Industry Cooperation, Department of Commerce. As explained by Alex Miller, Chief of the OIC, 3,000,000 more tons of purchased scrap will be consumed this year than ever before because of increased capacity and production—if the scrap can be obtained.

Mr. Miller explained that the needed scrap will come from old railroad cars and tracks, ships taken out of service, wrecked buildings, obsolete automobiles and trucks, old farm equipment, old industrial machinery, and odds and ends from junk yards. Householders will not be asked to aid this drive, since wartime collections rounded up some 3,000,000 tons, about cleaning up this source.

Seriousness of the lack of a backlog of scrap was emphasized in Mr. Miller's comment that in the event

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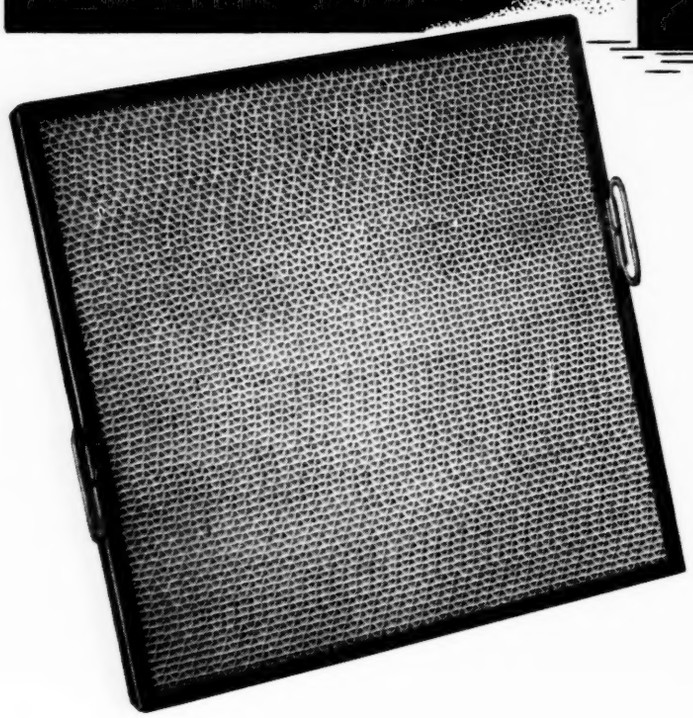

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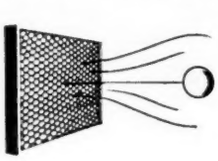

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of another war, 4,000,000 tons of scrap will be needed immediately in order to start full production. By that, Mr. Miller meant reopening of the production facilities designed exclusively for the manufacture of ordnance shapes. Wiping out of the backlog is due, Mr. Miller explained, to the fact that 123,000,000,000 tons of steel and steel products were exported during the war. Much of this is at the bottom of oceans or buried in Pacific jungles, he said, and must be written off as lost.

Steel Allocations?

Result is that it seems certain that steel allocations on a voluntary basis will be extended beyond the present authorized limit, March 1, and formal allocation later is not beyond the range of possibility. Heating and ventilating industries are not faring too badly under the present voluntary allocation program. Of the 10 allocation arrangements completed, heating and ventilating is either directly or indirectly affected by five.

The five, allotting specific tonnages of steel monthly are: warm-air heating, 29,170 tons; oil industry, 16,300 tons; barge repair, 20,000 tons; tanker repair, 40,380 tons, and coal industry, 2,570 tons. Heating and ventilating industries may also be considered indirect beneficiaries of the allocation of 250,000 tons monthly for construction of freight cars. Other allocations: atomic energy, 20,000 tons monthly; armed forces, 107,774 tons; steel houses, 9,830 tons, and aeronautic research, 1926 tons.

Gas Industry Expansion

Meanwhile, in the face of uncertainties regarding steel supplies, the country's distributors of natural and manufactured gas, have announced plans to spend an estimated $3.3 billion for plant expansion and improvements in the five years ending with 1952. The planned expansion is equivalent to 55% of the approximately $6 billion present investment in the business.

The industry is spending in 1948 an estimated $875 million, a record high. Largest previous amount was $800 million in 1947, when the total included an item of $143 million used in purchasing the Big Inch and Little Big Inch pipelines from the government for conversion into commercial natural gas carriers.

Construction of new facilities is expected to account for 90% of the proposed 5-year expansion budget. Natural gas companies will make 80% of the expenditure; manufactured gas companies 15%, and the balance will be spent by companies ssupplying a mixture of natural and manufactured gas. Completion of the program should eliminate bottle necks which are impeding installation of new heating and industrial equipment.

Building Codes

Another effort to do something about building codes and other factors slowing down construction is getting under way. First step is a fund-raising campaign to be set up on a five-year basis to provide $100,000 a year for activities of the Building Research Advisory Board, a new agency of the National Research Council, the administrative arm of the National Academy of Sciences. The fund-raising campaign is being led by the Research Activities Committee of the Construction Industry Advisory Council, Chamber of Commerce of the United States. The Industry Advisory Council is composed of more than 100 trade and professional associations with a major interest in construction.

Purpose of the Building Research Advisory Board is to collect, correlate and disseminate the results of the many separate research studies now being conducted in the field of building construction by contractors and builders, producers of materials and equipment, trade associations, universities, government agencies, and others. All elements of the building industry, including contractors and home builders, producers of materials and equipment, architects and engineers, and financial agencies, are being asked to subscribe to the fund necessary to initiate the five-year research program. Raymond J. Ashton, of Salt Lake City, past president of the American Institute of Architects, is chairman of the U. S. Chamber of Commerce committee inaugurating the fund drive.

The need for a correlating body under qualified, disinterested direction was given additional confirmation recently when Raymond M. Foley, Housing and Home Finance Administrator, turned to the National Academy of Sciences for advice in carrying out the directive of the 80th Congress, as expressed in the housing bill passed at the special session. The directive required the Administrator to conduct technical research and studies to develop and promote the acceptance and application of standardized building codes and of standardized dimensions and methods of assembly of home building materials and equipment.

Beyond Talk Stage

Worth noting by heating, ventilating and air conditioning engineers is the fact that construction of underground munitions plants in this country is beyond the conversation stage. First plant of its kind in the United States is being built on a 126-acre site in Springfield, Mass., by Smith & Wesson, Inc. Underneath each unit of the plant are tunnels equipped with air-tight bulkheads, double fire doors, and a suction air conditioning system to draw out any poisonous gases. Transformer facilities for the plant are dispersed underground in vaults, so that destruction of one transformer will not put the entire system out of operation. Plants are also to have duo-communication systems, dual water supply systems, and two sewerage systems.

Producers, distributors and users of copper and brass pipe will be interested in proposed changes in simplified practice recommendations. Copies of the proposal may be obtained from the Bureau of Standards, Washington 25, D. C.

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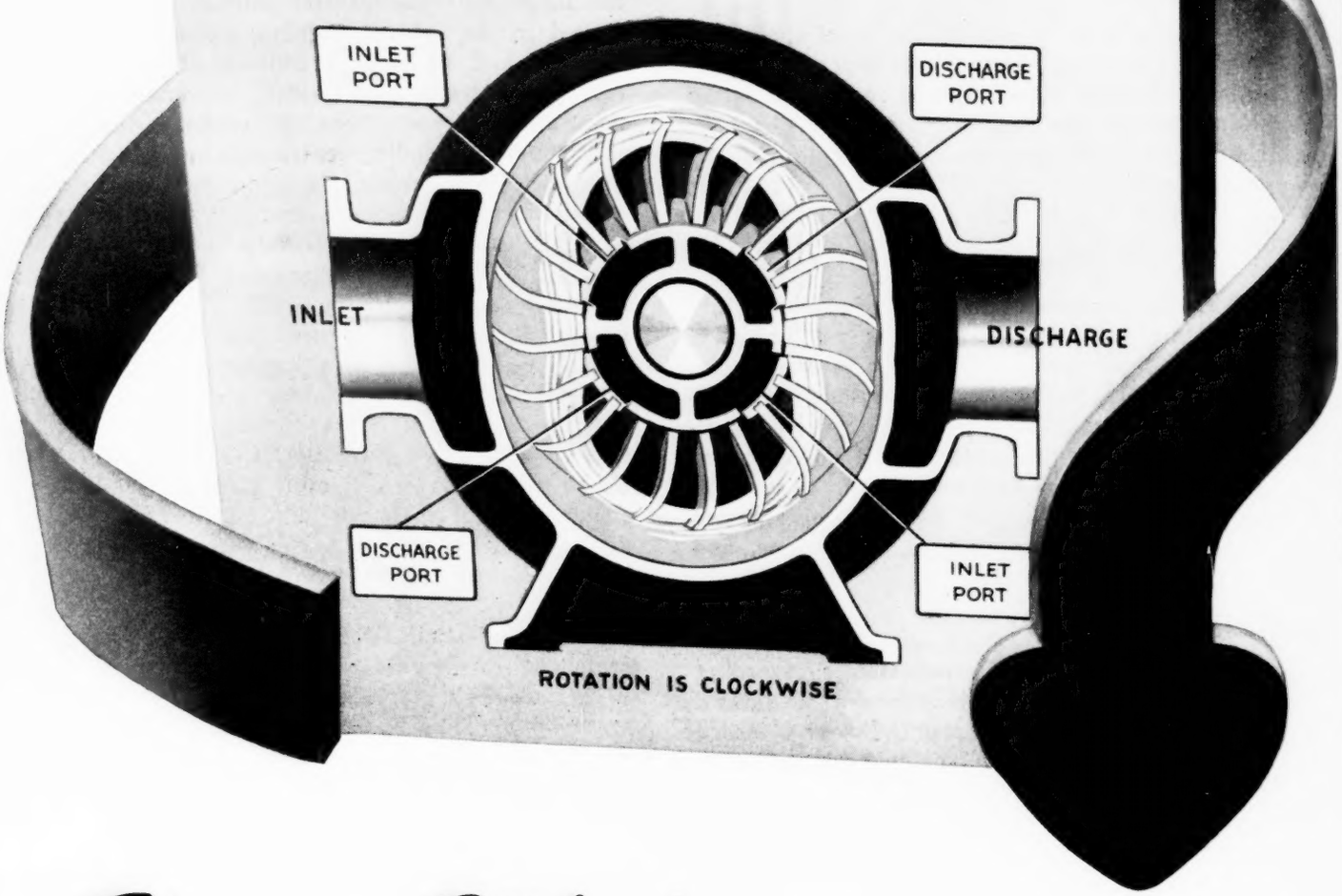

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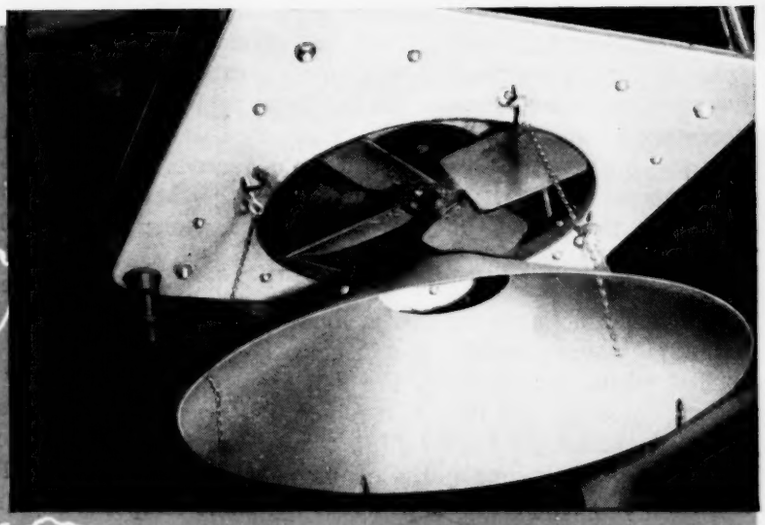


Unit Heaters Prove Successful in Greenhouse Heating

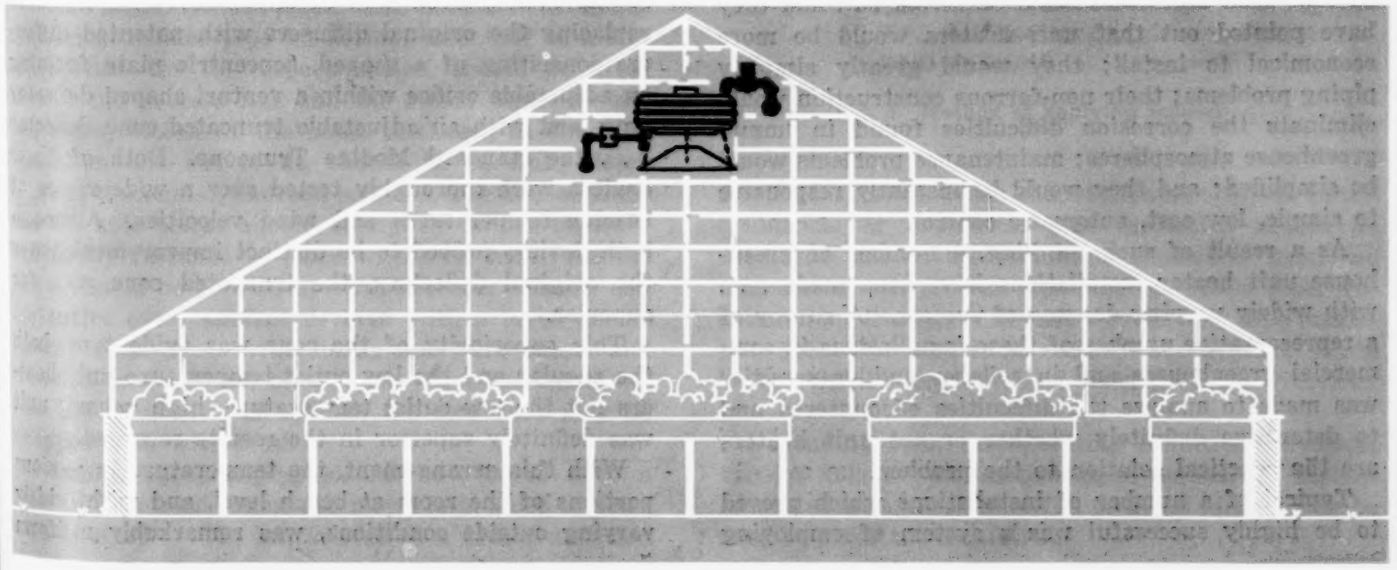
H. E. SMITH
Sales Engineer, Modine Manufacturing Co.

A successful greenhouse heating system at a mid-west state college uses vertical projection unit heaters with single, truncated cone deflectors. Mr. Smith discusses some of the factors involved in the heating of greenhouses with unit heaters.

GREENHOUSES have traditionally and almost universally been heated by means of pipe coils or cast iron wall type radiators installed under the raised plant benches. Can they be heated by other means? That is a question which has long challenged the thinking of progressive greenhouse operators, horticulturists, heating contractors and heating engineers who are aware of the many shortcomings of the time-honored pipe coil system and who have believed that the low installation and maintenance cost, plus the "controllability" of modern, light-weight suspended unit heaters can be as desirable in greenhouses as it has proved to be in other types of commercial and industrial buildings.

Pipe coils under the benches have never been entirely satisfactory but their inherent weaknesses often have been overlooked or accepted as being unavoidable because no better method appeared to be available. Greenhouse space is valuable space and all the floor area must, for economic reasons, be used for planting space or access aisles. Bulky coils or radiators above

Fig. 1. Position of vertical projection heater near roof of greenhouse.



the planting beds cast undesirable shadows, so the logical answer has been to use the otherwise waste space under the benches. Greenhouse operators admit, however, that such systems are far from perfect. The necessarily humid atmospheres cause rapid deterioration and high maintenance costs for the ferrous coils; installations are high; particularly if it is necessary to trench the return lines in large installations for clearance of doors and aisles; control, either automatic or manual, is costly because of the inherent sluggishness of large masses of ferrous surface in a building where almost instantaneous response is needed when, for example, the sun sets or the day becomes cloudy; and finally, much fuel is wasted because of excessively high ceiling temperatures. Most importantly, coils under the plant benches tend to maintain soil temperatures at about the same temperature as the air whereas most authorities agree that, except for specialized propagating beds, optimum plant growth is obtained with air temperatures closely controlled at about 10 degrees above soil temperatures.

New Methods

With increased interest being shown by greenhouse operators in the growing of plants at the ground level so that mechanical methods can be used to prepare and cultivate the soil thereby eliminating the conventional raised planting bench, the elimination of underbench heating coils becomes increasingly important.

Why can't light-weight, propeller type, suspended unit heaters be used to solve the problem? Unit heaters long ago superseded pipe coils in other types of commercial and industrial buildings. Why will they not also be superior for greenhouse heating?

Quite a few progressive greenhouse planners and operators and heating engineers have asked that question . . . and some negative reasons have been put forward.

"The air movement set up by unit heaters will be disastrous . . . it will dry out tender foliage . . . it will spread fungus disease spores."

"The shading effect of overhead unit heaters is unacceptable."

Many progressive planners, however, have contended that such difficulties could be solved . . . and they have pointed out that unit heaters would be more economical to install; they would greatly simplify piping problems; their non-ferrous construction would eliminate the corrosion difficulties found in humid greenhouse atmospheres; maintenance problems would be simplified; and they would be instantly responsive to simple, low cost, automatic control.

As a result of such thinking, a number of greenhouse unit heater installations have been made . . . with widely varying degrees of success. A survey of a representative number of these installations in commercial greenhouses and in colleges and universities was made to analyze the difficulties encountered and to determine definitely whether or not unit heaters are the practical solution to the problem.

Typical of a number of installations which proved to be highly successful was a system of employing vertical delivery (down blow) unit heaters installed in two large agronomy department greenhouses by a mid-western state college.

Each greenhouse was exposed on four sides and divided into three rooms 35 x 25 ft. They were of conventional design with ridge roofs and steel sash construction, with manually controlled ventilators and 30 in. high masonry side walls topped with 36 in. of glass. Each of the six rooms was heated with one vertical delivery unit heater centrally located under the ridge of the roof as indicated in Fig. 1.

Although each unit heater was selected to completely offset the total heat loss of the room in which it was installed, half of the units were of the conventional style having a final air temperature of about 115F when supplied with 2 lb steam and 60F entering air while the other half were of the low outlet temperature (high volume) type which were designed to deliver air at about 100F when supplied with 2 lb steam and 60F air. All units were equipped with thermostatically controlled automatic modulating steam valves and limit controls to stop the unit heater motors when the steam valves reached the "off" position. In this way, stratification was avoided because the unit heaters operated constantly as long as even a small amount of heat was required.

Originally, the units were equipped with diffuser assemblies consisting of four concentric, divergent cones which, although used through four heating seasons, were not entirely satisfactory. Such diffusers have proved to be very effective in normal building heating and air conditioning but in a greenhouse they did a too thorough job of air diffusion with the result that, although there was no trouble due to drafts, the heated air was not projected to the benches adjacent to the side walls making it difficult to promote vigorous plant growth around the perimeter of the buildings. Ceiling temperatures exceeded bench level temperatures by as much as 28 degrees and there was an objectionable temperature gradient in various portions of the same room as well as an unsatisfactory day to day variation due to fluctuations in the outside wind velocity.

Test Results

Improvements on this arrangement were tried by replacing the original diffusers with patented diffusers consisting of a shaped, concentric plate forming an adjustable orifice within a venturi shaped deflector ring, and with an adjustable truncated cone deflector . . . the standard Modine Truncone. Both of these devices were thoroughly tested over a wide range of outside temperatures and wind velocities. Although both devices proved to be distinct improvements over the original deflectors, the truncated cone was far superior.

This superiority of the cone was evident on both the regular and the low outlet temperature unit heaters but the low outlet temperature, high volume unit was definitely superior in the results recorded.

With this arrangement, the temperature in various portions of the room at bench level, and with widely varying outside conditions, was remarkably uniform

. . . varying not more than 3 degrees under the most unfavorable conditions. The "cold strip" around the edge of the room was completely eliminated, and there were no noticable drafts or objectionably strong air movements at any point . . . even directly below the heating unit. The differential between bench level and ceiling temperature was less than with any other type of heating system, being never more than 4 degrees and averaging 2.4 degrees.

It is important to note that these results, obtained by exhaustive tests throughout an entire heating season, were markedly superior to either pipe coils or cast-iron radiators. The uniformity and quality of plant growth was definitely improved and the process of regulating the rate of plant development to meet market demands was simplified because of the ease with which individual room temperatures could be varied.

In the opinion of the greenhouse operators, the shadow effect of the relatively small centrally located unit heaters was so unobjectionable as to be of no importance.

On the basis of this analysis the writer proposes the following for the guidance of the heating engineer:

(1) Unit heaters should be of adequate capacity to offset the heat loss of the greenhouse under the most severe conditions.

(2) Low pressure steam (or hot water) should be used as a heating medium and the cfm-Btu ratio of the unit should be such as to result in an outlet air temperature of approximately 105F under full load (design) conditions.

(3) An adjustable, truncated cone deflector should be used below the outlet of the vertical projection heater.

(4) An adequate system of automatic, modulating controls should be provided.

(5) Unit heaters must be so spaced as to adequately "blanket" the entire area with heated air. In the conventional long, narrow house not exceeding about 40 ft in width, a single row of units down the center should be spaced no further apart than the width of the house.

Although the information accumulated in this survey may admittedly be elaborated upon by future observation of, for example, installations in the lean-to type of greenhouse, these results clearly indicate the heating of conventional greenhouses by means of propeller type unit heaters is not only practical but extremely desirable.

Insulating Procedure for Steam-Traced Pipe Lines

Suggestions on insulation of steam-traced or steam-wrapped piping with molded insulating materials such as 85% magnesia or diatomaceous silica are offered by the Magnesia Insulation Manufacturers Association.

In the case of steam-traced piping, a steam line, generally 1 in. or less in diameter, is run parallel to a process line carrying material which must be kept hot. With steam-wrapped piping, the steam line is wrapped spirally around the process line. In either case the insulation construction should surround both pipes so as to permit the heat to be transferred from the steam to the process line.

With steam-traced lines, half-sections of semi-cylindrical molded pipe insulation, each half of a size appropriate for its respective line, should be fitted around the process line and the steam pipe. At the two sides, blocks of the same thickness as the pipe insulation and cut to fit, should be carefully fitted between the semi-cylindrical sections. The half-sections and the side blocks should be tightly butted together and firmly fastened in place with iron wire. All the joints should be pointed up with asbestos cement, and the entire outer surface covered with a layer of the cement reinforced with hexagonal wire mesh and troweled to a smooth, hard finish. In some cases, before the insulation is applied, the two lines may be wrapped with wire mesh.

Steam-wrapped piping should be covered with a layer of galvanized expanded metal lath, laced in place with iron wire. The lath serves as a firm foundation for the insulation which should then be applied. Semi-cylindrical or segmental pipe insulation should be used, the size of the insulation depending upon the diameter of the process pipe plus the steam pipe. Insulation application is the same as for any pipe insulation job. The insulation sections are applied, joints butted tightly together, and fixed in place with iron wire.

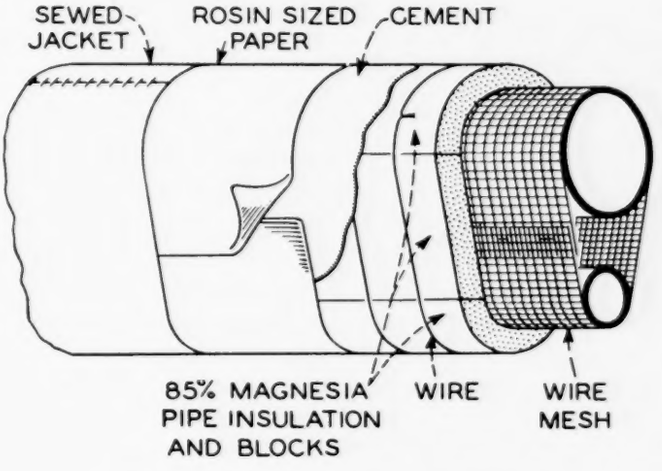


Fig. 1. Method of applying insulation.

Depending upon the operating conditions involved, various finishes such as cement, sewed canvas, asphalt saturated asbestos roofing felt or metal jackets may be used to cover the insulation.

Design Features of Centrifugal Pumps

EDWARD J. ACKERMAN
Assistant Engineer, Mechanical Engineering Department,
Consolidated Edison Co., New York, N. Y.

Discussion of six major design factors in evaluating the merits of centrifugal pumps so that the purchaser may receive maximum value.

THE prospective buyer of a centrifugal pump is often called upon to choose between various design features which are difficult to evaluate without benefit of a long and varied operating experience that accrues to relatively few engineers. Yet in order to make a choice from the mechanical standpoint, that will result in the greatest value for the money spent, some knowledge of the relative merits of these features are essential.

This discussion concerns the following major items involved in evaluating design against price: Pump characteristics, drive, bearings, shafts and shaft sleeves, wearing rings, and impellers and casings.

Pump Characteristics

First consideration should be an analysis of the pump characteristic curves submitted with the proposal. On these curves, the pumping head, horsepower and efficiency are plotted against capacity. Suitability of the pump for the specified capacity and head is readily established from these curves. Obviously, the pump with the best efficiencies in the operating ranges will require the least power. See Fig. 1. High efficiency, however, while very desirable, must be considered in the light of the other factors.

For most applications, a centrifugal pump should have a constantly rising head curve from maximum capacity to "shut-off" at zero capacity. It will be noted from the typical pump curve that the pump has a definite capacity when pumping against a particular head. Should the head curve rise to a maximum point and then start to drop as it approaches shut-off, the pump will have two different capacities for the same head. This may cause the condition known as hunting, as the pump capacity shifts between the two ratings common to that pressure.

This condition becomes particularly undesirable when two or more pumps must operate in parallel. Instead of dividing the load evenly, each pump may operate at one of the capacities common to the head. Furthermore, each of the pumps may start hunting between the two capacities.

For most installations the degree of slope need be only sufficient to avoid this condition. On the other hand, if pressure control valves are to be installed in the pump discharge, the degree of slope might be important. When it is desirable that a small movement of the control valve should cause a relatively great or a rapid change in capacity, a head curve with a gradual rise would be advantageous. If the reverse condition is desired, that is, a small change in capacity for a relatively large drop across the control valve, the curve should rise steeply.

Drive

Factors governing the type drive best suited for any particular installation are not within the province of this article. But having made the choice, selection of the proper rating of the drive is important. A turbine driven centrifugal pump has great flexibility over a relatively wide operating range, made possible by the variable speeds at which the unit may be operated. If the steam capacity of the throttle valve and the nozzles are ample to permit the turbine to develop the horsepower required when operating at the maximum speed of the range selected, the drive will undoubtedly meet all expected requirements. However, most centrifugal pumps by far are driven by constant speed motors and the size selected must be given careful consideration.

Unless cheapest first cost is essential to

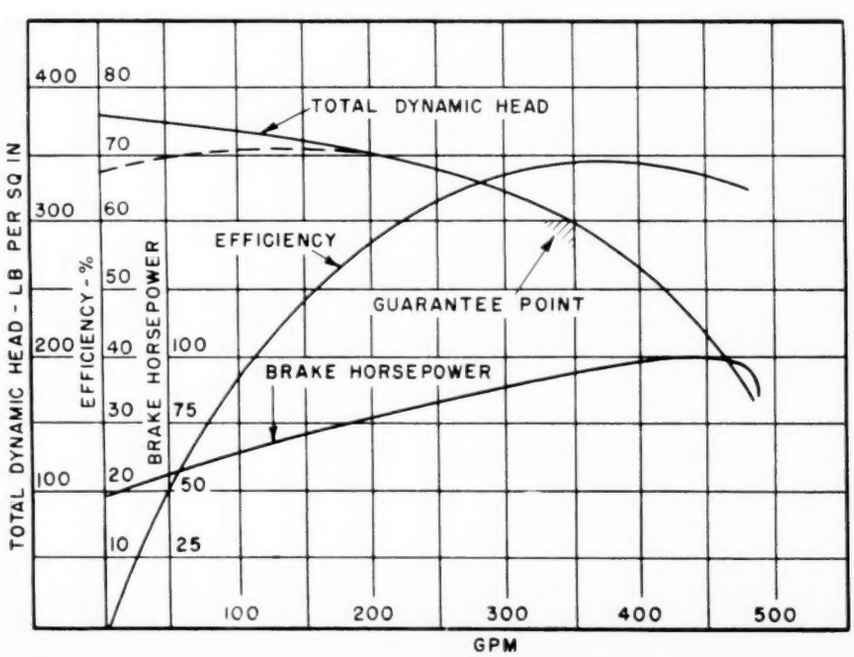


Fig. 1. Typical pump curve showing rising head characteristic, efficiency, brake horsepower and guarantee point. Dotted line shows unsatisfactory drooping head characteristic.

the economics of the installation, or pumping is intermittent and of relatively short duration, or continuity of service is not a major consideration, then the motor selected should be of a rating sufficiently ample for the pumping load over the entire range of the pump without overloading. By overloading is meant that load at which the motor manufacturer will caution the purchaser to expect accelerated depreciation of the winding insulation due to heating, with resultant shortened life of the motor.

System conditions for most pumping installations rarely remain so fixed that the head which the pump must develop never varies. When the system head is reduced, the rate of flow increases with a resultant increase in power input. A motor that may be amply rated for the specified head and capacity may be overloaded, within the meaning of this term, at other pump ratings. The cheapest way, in the long run, to insure uninterrupted service over the greatest number of years is to provide a motor suitable for the pump at any rating within the range of the pump.

Bearings

Most pump manufacturers have practically standardized on ball bearings. It is becoming increasingly difficult to obtain pumps of standard design equipped with babbitted sleeve-type bearings in spite of the fact that there are still many proponents of the latter type. There is, of course, much to be said for both types.

Ball bearings, being of shorter length than the sleeve type, permit pumps to be made with shorter shafts and correspondingly shorter over-all lengths. This may be advantageous where space is at a premium. With a shorter span, the shaft diameter may be reduced which permits an impeller of smaller over-all diameter. The effect of all this is a pump which, rating for rating, is smaller and less expensive to produce than a sleeve bearing pump.

With the ordinary care prescribed by the manufacturer, and using the grade of lubricant he recommends, ball bearings should give long uninterrupted service. The difficulties encountered in their use are generally not inherently the fault of the bearings, but in the manner of care given them.

Ball bearings as applied to pumps are mostly grease lubricated and only a thin oil film is required over the balls. This provides what little lubrication is necessary and also furnishes a protection against corrosion. It is strange how difficult it often is to convince the oiler that since a little grease is good, that too much can be disastrous. Too often fresh grease is injected into the housing at intervals until it becomes packed, with resultant overheating and breakdown of the bearings. To prevent this, plugs are provided to permit old grease to be withdrawn when fresh lubricant is added. Bearing failure is sure to follow when this operation is overlooked or neglected.

When such failure occurs, it is necessary to open the pump casing to permit removal of the rotor for bearing replacement. Due to the breakage of the balls, journal damage is usually severe.

Sleeve bearings are oil lubricated and except for special applications, one grade of oil will generally suffice for all such bearings in the plant. The responsibility of the oiler consists simply in seeing that the oil cups are filled.

Should bearing failure occur, the damage to the journal, if any, is usually less severe than with ball bearings, and replacement can be accomplished without removing the shaft, since the bottom half-segment of the bearing can be slid from under the journal. This greatly simplifies the replacement operation with a consequent shorter outage of the pump.

The engineer, then, in choosing between ball or sleeve bearings should weigh cheaper first cost and greater compactness of the pumps against a simpler oiling regimen, cheaper bearing replacement costs, and greater pump availability due to shorter shutdowns caused by bearing failures.

Shafts and Shaft Sleeves

For pumping fresh water or non-corrosive fluids, a cold rolled carbon steel shaft should give good service. For brackish or salt water, stainless steel or monel shafts should be considered in spite of their premium costs, if long and continuous service are prime factors. For other more corrosive fluids, the recommendations of the pump manufacturers' metallurgists should be enlisted.

Since shaft sleeves are rather generally employed to protect the shaft, one may question why expensive alloy shafts should ever be necessary? The answer is because sleeves seldom give 100% protection. Too few engineers seem to recognize that shaft breakage, a common cause of pump failure, is more often attributable to poorly fitted shaft sleeves than perhaps any other single cause. Most shaft sleeves are designed to butt against the hub of the impeller in a metal-to-metal joint and unless this is fitted to be fluid tight,

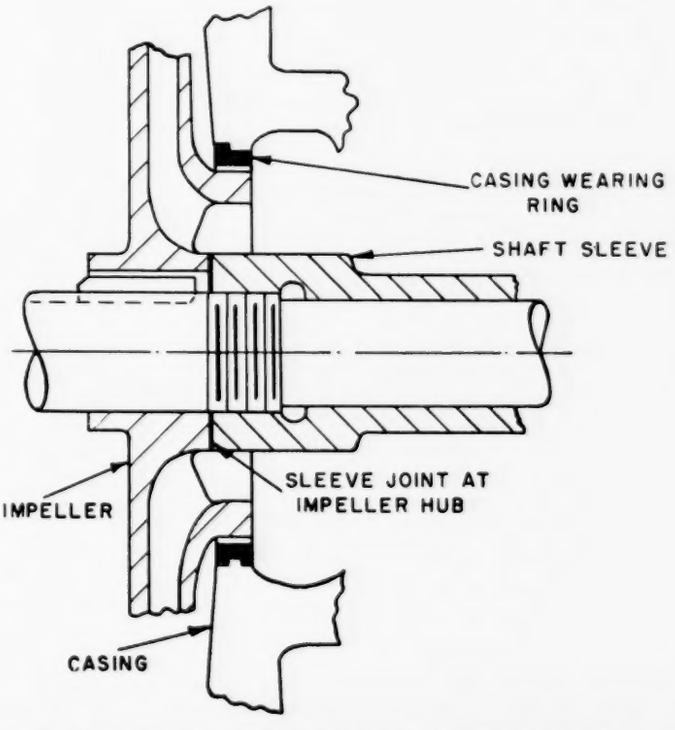


Fig. 2. Location of sleeve joint at impeller hub where shaft breakage occurs.

the shaft will eventually break at this point, and which side goes first is only dependent on which side leaks worse.

Engineers cannot be too particular in considering the fit of the shaft sleeves, and they should not be lulled into a false sense of security by the inclusion of a non-metallic gasket. Such gaskets do not stand up under the severe strain of the service. When they deterioriate, the shaft becomes vulnerable.

Shaft sleeves are held in position by threads on the shaft. When expansion and contraction is anticipated, the threaded sections are located adjacent to the impeller hub to permit expansion of the sleeves toward the free outer ends. Otherwise, some manufacturers locate the threads outside of the pump casing and hold the sleeves in place by means of threaded collars. For the sake of standardization, however, most designs conform to the first arrangement, and this often leads to a complication. Since the threads are in the field of the fluid pumped, they often become corroded, and sleeves are removed for replacement only with great difficulty. Therefore, it is not unusual to find it necessary to re-machine the shaft threads or even to replace the whole shaft.

Placing the threads external to the pump casing even when possible is not an ideal solution either. To prevent the sleeve from slipping on the shaft due to the pressure of the packing, the inside end is usually slotted around a shaft key. This invariably permits leakage around the key with attendant corrosion of the shaft.

In considering these features of the pump with a knowledge of what may be anticipated, the engineer, obviously, must choose between the best of the designs offered, as viewed in the light of his judgment for the particular application.

The other function of shaft sleeves is to protect the shaft against the rubbing action of the packing where the shaft goes through the stuffing boxes. For the service both of the types of sleeves are satisfactory. In this connection, it might be mentioned, that a good deep stuffing box is better than a good shallow one. Some preference should be extended to the design that permits an additional ring or two of packing. Leakage through the stuffing box is controlled easier and the unit pressure on the sleeve is proportionately reduced.

Wearing Rings

To avoid excessive internal leakage or by-passing of the fluid pumped, a small clearance must be retained between the pump casing and the hubs of the rotating impeller. Flow of the fluid through these internal passages is a cause of unavoidable wear. Most pumps are provided with replaceable casing or stationary wearing rings at these points which serve a double purpose. They protect the pump casing, and by replacement, permit the original clearances to be re-established with resultant maintenance of pump efficiency.

Pumps are often provided with a set of companion rings on the impeller hubs and they are intended to serve the same functions.

Divided opinions are prevalent among operating engineers as to the value of the impeller wearing rings. The casing rings are usually easy to remove and replace and are a good investment in any pump. On the other hand, impeller rings are often difficult to loosen from the impeller and removal may cause sufficient damage to the impeller to make a ring replacement impossible without a great deal of machining. For this reason, manufacturers often eliminate the impeller rings on the assumption that it is more practical to dress the impeller hubs after wear has occurred, and replace the original casing rings with oversize rings to establish the original clearances.

Wearing rings are usually designed with a straight passage between the concentric faces, but some manufacturers favor the labyrinth or step design. In these types, the leakage, in passing from the pressure region to the eye of the impeller, has a relatively longer travel than in the straight-through type. The resistance to flow, therefore, is increased in the labyrinth type and less leakage is supposed to be sustained for any given clearance. Likewise, for the same leakage, it is claimed that wider clearances may be used.

Theoretically, it would be difficult to disprove these claims, but it has been the writer's experience that in actual practice, pumps equipped with labyrinth wearing rings do not show higher efficiencies than pumps not so equipped, nor do they necessarily hold their original efficiencies over longer periods.

The engineer, in evaluating these features of a pump, should insist on casing or stationary wearing rings. But if the application entails no unusual features or troublesome fluids, he should manifest unwillingness to pay a premium price for a pump simply because it is equipped with impeller rings or rings of the labyrinth type.

Impellers and Casings

Impellers, even though the heart of the pump, seldom are a source of pump failure providing the pump is operated under proper suction conditions. When the pump suction connection is kept flooded under all conditions of operation to minimize cavitation, the impeller will give long continuous service. This assumes, of course, that the material of construction is suitable for the fluid pumped.

This may also be said for the pump casing. Practically the only requirement for long service is in the choice of a proper material for the fluid to be handled. One point of caution in this regard may not be amiss. Cast iron pipe generally has a satisfactory life for salt water lines, but cast iron pump parts will not stand up for this service. The surface film on an iron casting resists corrosion of salt water, but when this film is machined away, as it would on a pump casing or other parts, its service life is so reduced as to render it unsuitable.

It should be repeated that while this discussion applies generally to most pump applications, it is intended particularly to cover the choice of pumps where no unusual operating conditions are anticipated. When high temperatures and pressures, or special fluids are involved, the approach to a proper evaluation must be altered in the light of the specific application of the equipment.

Proper Tension for a V-Belt Drive

FRANK H. RUMBLE

Texrope Drive Department, Allis-Chalmers Manufacturing Co.

A V-BELT derives its grip from the wedging contact between the sides of the V-shape belt and the walls of the V-shape grooves of the sheaves. Because this grip is so effective, a V-belt requires less tension than a round or flat belt which depends for its grip solely on frictional contact. However, to operate correctly and to assure longest life of both belts and sheaves, a V-belt drive must have adequate tension on the belts.

Therefore, because of the nature of the V-belt drive and the generally accepted fact that it requires less tension than other types of belt drives, there is little danger of a properly engineered V-belt drive having too much tension on the belts. Experience shows that there are probably a great many more V-belts operated with too little tension than there are belts with too much tension. Sagging belts very often indicate inadequate tension. The simple process of putting more tension on the belts not only improves the appearance of the drive but adds greatly to belt life.

It is assumed that every V-belt drive has been carefully engineered in accordance with widely known V-belt standards, that sheaves and belts are large enough, that the drive has sufficient overload capacity, that belt velocity is not excessive and that adequate means have been provided for belt take-up. The matter, then, of operating the drive with the correct amount of tension on the belts is a very important problem.

It is difficult and impractical in the average shop or factory, because of the special machine required, to actually measure the pounds of tension which is applied to the belts on any particular drive. Therefore, the average user is forced to rely on some practical and inexpensive method of approximating the correct belt tension. Since experience is perhaps the best teacher, the experienced operator can tell from observation and feel of a V-belt drive, whether or not it has sufficient tension.

There are many rules of thumb to determine V-belt tension. Perhaps the best one is this: A slack V-belt feels dead when thumped with the hand; a properly taut V-belt has an alive springiness.

Another method of ascertaining if sufficient tension has been applied is through use of a tachometer. After a new set of belts has been installed and tension applied according to instruction of the manufacturer, the speed of driven shaft should be checked against that of motor shaft under full load, and if slip is indicated, further tension applied. They should be checked again in a few days. If no slip is in evidence, the initial stretch has been eliminated. Speeds should be checked at regular intervals to insure that the tension is maintained.

Studies regarding V-belt tension show that best results and longest belt life are obtained on drives where it has not been necessary to adjust tension too frequently and where there have, consequently, been long and perhaps irregular intervals between periods of belt adjustment. This is another way of saying that best results are obtained when sufficient tension is put on the belts initially. When belts are first installed, it is necessary to adjust them several times by applying more tension until the initial stretch is eliminated. After this time, however, the tension put on the belts should be sufficient to last for a comparatively long period. They should be checked regularly to see that this tension is maintained.

Over the period of its entire useful life a standard V-belt of rubber, cord and fabric will show a stretch of approximately 4%. This stretch is effected gradually and may only become apparent after the belts have been under tension for a relatively long period. Experience shows that a tension equivalent to 0.5% stretch is not only non-injurious to V-belts, but is approximately the tension under which they should operate to give best results.

Here is a method which utilizes these facts and which is sometimes used to approximate the correct tension when a drive is first installed. After the V-belts have been placed in position and the drive turned over several times to properly seat the belts, the motor is backed off sufficiently to take all sag out of the belts. From this point the motor is moved back a distance equal to 0.25% of the pitch length of the belts. This will produce about 0.5% stretch in the total length of the belts. The resultant amount of tension for the specific installation should be maintained through periodic checks.

A large ventilating fan V-belt drive, showing how motor is mounted on an adjustable base for varying belt tension.

What Causes Corrosion of Metals?

WILLIAM H. LANG

Discussion of what causes corrosion. Explanations are given of the various theories that have been advanced including the widely accepted electrochemical theory, and the findings of Dr. F. N. Speller.

CORROSION of metals is something which most persons have observed. However, in the majority of cases, it was not thought of as corrosion, but as the very familiar rusting of iron.

In definition, corrosion of a metal is stated to be the chemical action of its environment usually resulting in its deterioration and destruction. When a metal corrodes, it is due to its not being stable in its environment, and as a result, it tends to change or revert to a more stable form, usually an oxide. The oxide is the most stable form of metal, and it is in this form in which most metals are found in nature. However, corrosion products can also be carbonates and sulfides of the metal as these are also stable forms.

Several theories have been advanced as explanations of the causes of corrosion. It is believed that Calvert (1) was the first investigator to conceive the idea that the presence of an acid was necessary for corrosion to proceed, and this resulted in the formulation of the *acid theory*. In this, it is stated that a small amount of some acid such as carbonic is always necessary to start corrosion.

The theory describes the corrosion process as a cyclical action in which there are three primary factors: Acid, water and free oxygen. The carbonic acid starts the series of reactions in the first of which iron is dissolved as follows:

$$Fe + H_2CO_3 = FeCO_3 + H_2$$

The ferrous carbonate formed in this reaction is then oxidized to ferric iron by free oxygen in the presence of water with the liberation of free carbonic acid according to the following reaction:

$$4FeCO_3 + 10H_2O + O_2 = 4Fe(OH)_3 + 4H_2O + 4CO_2$$

The hydrogen formed in the first of these two reactions is removed from the cycle by being oxidized to water, thus leaving the acid free to act again on the metal to form more ferrous carbonate, which is subsequently oxidized to ferric iron or rust.

Although this theory will explain corrosion in water where carbon dioxide is present, it has been found that corrosion will take place in the absence of carbon dioxide and other dissolved acids.

The *colloidal theory* postulated by Friend (2) refers to the importance of colloids as carriers of oxygen and as accelerators of corrosion. According to this theory, iron in contact with water in the presence of air or oxygen is oxidized to ferrous hydroxide, a colloid or hydrosol. This material is alternately reduced in contact with the iron and oxidized again by oxygen. When the iron hydroxide precipitates, rust is produced. In considering this theory, it is indicated that anything that precipitates or removes the colloid will retard corrosion.

According to the *theory of direct chemical attack by oxygen*, the metal is oxidized directly to the hydroxide. This theory explains part of the corrosion phenomena but fails to account for many established facts.

The *biological theory* states that certain bacteria are capable of removing iron from water and depositing it on or within their bodies. If allowed to persist, these organisms exhibit colonial growth resulting in deposits within pipe lines and on other surfaces causing considerable trouble.

It is generally known that corrosion can take place in water free from organic matter; and although some organisms can metabolize iron, none are known which actively attack iron. It then follows that the iron has to be dissolved and made available for the organisms.

Pronounced corrosion at pipe threads by oxygen.

Author was formerly chief chemist and bacteriologist, Newport News, Va., Waterworks Commission and associate editor, *Water Works Engineering*, New York, N. Y.

This theory does not attempt to explain how the iron is dissolved.

Corrosion of iron, due to the decomposition of water by the corroding metal, is the basis of the *peroxide theory*. The decomposition of the water takes place according to the reaction:

$$Fe + 2H_2O = Fe(OH)_2 + 2H$$

The liberated hydrogen then was thought to react with oxygen of the water to form hydrogen peroxide, H_2O_2, which simultaneously oxidized the ferrous hydroxide to ferric hydroxide or rust, and metallic iron to ferrous hydroxide.

Hydrogen peroxide has been detected during the corrosion of some metals but never in the case of iron. Experiments have revealed that neutral hydrogen peroxide has no affect on iron and many agents which destroy hydrogen peroxide do not stop corrosion.

The theory most adequately explaining corrosion is the *electrochemical theory* which has been widely accepted. It is now established that the driving force of the corrosion reaction between the metal and its environment is electrochemical. The tendency of the reaction to proceed is determined by the magnitude of the electrochemical potential which naturally varies with the environment and the nature of the metal. However, the rate of corrosion is determined by the resistance created by the corrosion by-products to the continued progress of the reaction.

Basic Facts Regarding Corrosion

According to Speller*, fifteen facts have been established with respect to corrosion, particularly of iron, and which should be understood in order to appreciate more fully the mechanism of corrosion. These are:

(1) At normal temperatures, iron will not corrode appreciably in the absence of moisture.

(2) Oxygen is necessary for corrosion occurrence in ordinary water. Oxygen alone will cause corrosion in acid, neutral or slightly alkaline waters, while in natural waters the corrosion rate is always directly proportional to oxygen concentration provided other factors remain constant.

(3) Corrosion in acid solutions is more rapid than in neutral solutions while the latter is more rapid than in alkaline solutions.

(4) During corrosion in acid solutions and concentrated alkaline solutions, hydrogen is usually evolved from the metal surface, while in neutral solutions, the gas production may not be appreciable.

(5) Products of corrosion generally consist of black or green ferrous hydroxide next to the metal while the outer layer of the corrosion product deposit consists of reddish-brown ferric hydroxide or rust with graded mixtures of the two in between.

(6) When corrosion occurs in natural water, the precipitated rust usually occludes some compounds containing lime, magnesia and silica and other insoluble material from the water which influence the structure and density of the rust coating on the metal surface. Loose non-adherent coatings may accelerate local corrosion while a uniformly dense coating may decrease the rate.

(7) Surface films, sometimes invisible, often control the rate and distribution of corrosion.

(8) Usually the initial corrosion rate is greater than that after a short period of time.

(9) Corrosion at normal temperatures increases with increase of concentration in dilute solutions of many neutral salts but decreases again in more concentrated solutions, other factors being equal.

(10) Except where the film-forming tendency predominates, corrosion in natural waters generally tends to increase with increase in velocity of motion of the water over the metal surface.

(11) Dissimilarity in the chemical composition of metals in contact with each other in an electrically conducting solution, sets up a difference in potential and accelerates corrosion locally. The flow of the electric current through the solution is from the anode to the cathode or from the more corroded to the less corrodible metal.

(12) Common variations in composition of ordinary commercial iron and steel have little effect on underwater or underground corrosion but may be very pronounced on atmospheric and acid corrosion. Homogeneity of the metal usually is less important than external conditions.

(13) In submerged corrosion, the condition of the metal surface may not affect total corrosion but may tend to localize the action. Corrosion of iron is rarely uniform over its surface.

(14) Variations in the composition or concentration of a solution in contact with a metal tends to localize corrosion at certain areas and retard the action at other areas. A portion of the metal surface which is protected from diffusion of oxygen inward becomes anodic to other areas which are in contact with a solution richer in oxygen in which corrosion is more active at such protected areas.

(15) The smaller the anodic areas in relation to the associated cathodic areas, the greater is the rate of penetration of corrosion at the anodic points. The polarity of a certain area often reverses during the progress of natural corrosion.

Progress of Corrosion in Water

With these facts established, Speller summarizes the factors which determine the progress of metal corrosion in water:

(1) When iron is placed in contact with water or a solution, it has an inherent tendency to go into solution in the form of electrically charged particles such as iron ions. However, as the solution must remain neutral, positive ions cannot enter the solution unless an equivalent number of positive ions of some element are displaced from it. This is illustrated by immersing iron in a copper sulfate solution in which positive iron ions enter the copper solution and displace positive copper ions from the solution which are

*By permission from *Corrosion: Causes and Prevention*, 2nd Edition, by F. N. Speller. Copyrighted, 1938, by McGraw-Hill Book Co., Inc.

deposited on the iron surface. When iron is immersed in water, the element plated out on the iron surface is a very thin film of hydrogen.

Persistence of the hydrogen film can obstruct corrosion progress by insulating the iron from its environment and also by the tendency of the hydrogen in the film as it is built up to re-enter the solution. This is the first stage of corrosion.

(2) If corrosion is to proceed, the hydrogen film must be destroyed. This will occur if the hydrogen combines with existing oxygen to form water or if bubbles of the gas escape. When the film is broken, the metal surface is again exposed and more iron will go into solution with the formation of another hydrogen film at a rate determined by the speed of film removal. This is the second stage of corrosion.

In general, the rate of film destruction is dependent on the effective concentration of dissolved oxygen in the water next to the metal which in turn depends upon the degree of aeration of the water, temperature, presence of salts and quiescence or motion of the water. The reason that corrosion is accelerated in acid solution is due to the fact that as acidity increases, the hydrogen formation increases, which results in a pressure sufficient in the gas film to form bubbles and the hydrogen escapes, thus destroying the film.

The iron which enters the solution is usually precipitated as rust. This may affect corrosion continuation in that as iron is removed from the solution, new iron goes into solution, thus facilitating corrosion. If the precipitated rust forms a deposit on the metal surface, corrosion may be inhibited. However, when the oxygen supply is limited, it is gradually removed by combination with iron with further corrosion being decreased.

According to the electrochemical theory of corrosion, the primary reactions of the process is:

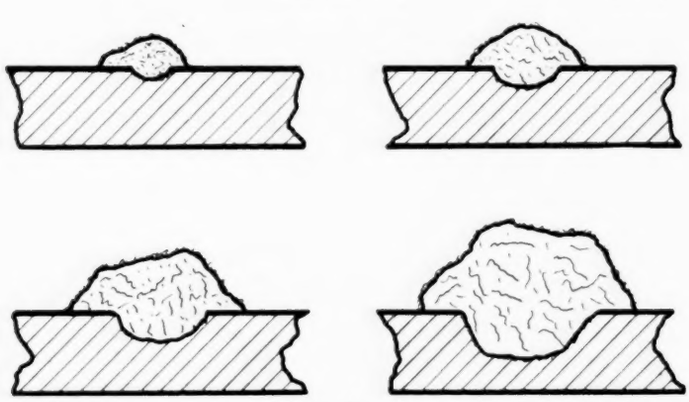
$$\underset{\text{metal}}{Fe} + \underset{\text{ions}}{2H^+} = \underset{\text{ions}}{Fe^{++}} + \underset{\text{atoms}}{2H} \qquad (1)$$

which is followed by the destruction of the hydrogen film with the formation of water as:

$$\underset{\text{atoms}}{2H} + \underset{\text{dissolved}}{1/2O_2} = \underset{\text{liquid}}{H_2O} \qquad (2\text{-a})$$

or by the escape of hydrogen as gas bubbles:

$$2H = H_2 \qquad (2\text{-b})$$



Illustrations, Courtesy W. H. & L. D. Betz

Various stages of pitting.

Relative Importance of Factors Affecting Corrosion

Alkaline Zone pH 10	Neutral Zone pH 4.3 — 10.0	Acid Zone pH Less Than 4.3
Corrosion Slow	Corrosion Medium	Corrosion Rapid
Protective films	Oxygen concentration	Hydrogen-ion concentration
Oxygen concentration	Protective films	Hydrogen overvoltage
Composition of metal	Hydrogen-ion concentration	Composition of metal
Hydrogen-ion concentration	Composition of metal	Oxygen concentration
Hydrogen overvoltage	Hydrogen overvoltage	Metal-ion concentration
Metal-ion concentration	Metal-ion concentration	Protective films

Reactions (2-a and 2-b) permit (1) to proceed resulting in an accumulation in the solution of Fe++ which is oxidized and precipitated as rust by:

$$2Fe^{++} + 1/2O_2 + H_2O = 2Fe^{+++} + 2OH^- \qquad (3)$$

The conditions affecting these reactions are classified as primary factors — those influencing reaction (1); secondary factors — those which affect the rate of the rest of the reactions. In general, the primary factors are concerned with the metal while the secondary factors deal with the environments. These are listed below:

Primary

Effective electrode potential of a metal in solution.
Overvoltage of hydrogen on the metal.
Chemical and physical homogeneity of the metal surface.
Inherent ability to form an insoluble protective film.

Secondary

Hydrogen-ion concentration or pH in the solution.
Influence of oxygen in solution adjacent to the metal.
Specific nature and concentration of other ions in solution.
Rate of flow of the solution in contact with the metal.
Ability of environment to form a protective deposit on the metal.
Temperature.
Cyclic stress or corrosion fatigue.
Contact between dissimilar metals or other materials as affecting localized corrosion.

Speller, further discussing corrosion, lists the various factors which affect corrosion in their order of importance in alkaline neutral, and acid solutions as found in the above table.

In an article such as this in which an attempt is made to cover a broad field it is not possible, due to space limitations, to cover the various phases as adequately as desired. It is, therefore, suggested that for more detailed information on the particular phase, the references at the end of the article be consulted.

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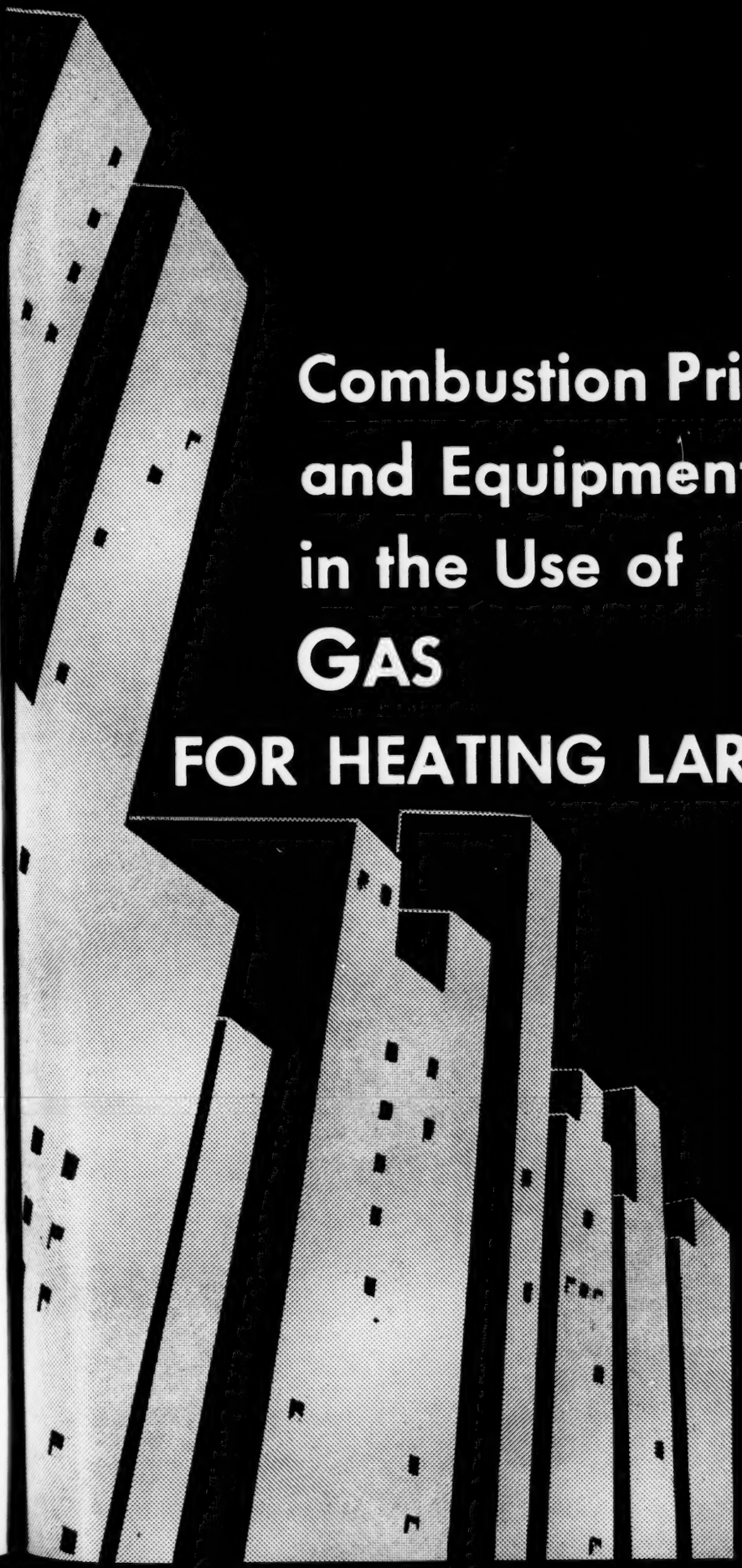

Combustion Principles and Equipment Selection in the Use of GAS FOR HEATING LARGE BUILDINGS

C. GEORGE SEGELER

Engineer of Utilization,
American Gas Association

A HEATING AND VENTILATING Reference Section

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Gas for Heating Large Buildings

C. GEORGE SEGELER
Engineer of Utilization, American Gas Association

For boilers larger than usual home sizes, there is little standardization in the selection of gas burning equipment. Therefore, there is a wide margin for skill and judgment open to engineers in specifying larger gas jobs. Mr. Segeler outlines factors involved and equipment available.

THE installation of gas boilers in homes within the range of sizes that can be heated by approved gas designed units is well standardized and generally presents no unusual problems. Even the installation of conversion burners of smaller size presents no real challenge to the heating engineer. However, once the invisible line is crossed, and large boilers, whatever their exact definition may be, are under consideration, there is but little standardization. On the contrary, there is ample opportunity to demonstrate skill and judgment in making a first class gas installation, reasonable in first cost, efficient and safe in operation, and free from service complaints.

The popularity of gas for heating increased rapidly during the '30's, undoubtedly accelerated by the increasing availability of natural gas. This made it possible for building owners to adopt gas for heating in many types of installations, at least until the outbreak of the war temporarily stopped gas sales for heating purposes. At the end of hostilities, a rush to gas started at such a pace that today gas shortages have once more stopped sales in many areas. Not until steel for pipe and equipment is once more in ready supply can this condition be expected to change although the gas industry is leaving no stone unturned in its effort to bring gas service to the thousands that are already on the waiting lists.

Objectives

This material has been prepared with several objectives in mind; first, to aid those already using gas in a better understanding of the principles of safe efficient use; second, to outline the elements of design and application of gas to new installations.

Aimed at multi-family dwelling and commercial building boiler applications it follows that the discussion will center about cast-iron and steel fire tube boilers designed for coal but fitted with gas burners. Steel water tube boilers are generally used in jobs larger than those covered here. The range of sizes is roughly from 10 hp to 250 hp. Strictly, approved gas designed boilers (largely cast iron sectional types) are available up to 16,000 sq ft of steam radiation (115 hp) in single units. However, these boilers are not generally used for commercial or process steam purposes since allowable steam pressures are limited.

For reasons of space, the combination gas and oil burners have not been extensively discussed although it is recognized that these types must be used in cities where gas is purchased under so-called interruptible gas contracts designed to provide gas service at quite low prices except during the peak load period when the utility company may be hard pressed to meet its gas demands. These tremendous peak loads are of themselves largely the result of the unprecedented increase in the use of gas for domestic heating purposes.

Gas Applications

While the selection of gas for heating is necessarily based on the economics of the individual jobs, attention is directed to the importance of other factors besides bare fuel costs. It is generally true that even relative fuel efficiency, boiler room labor and maintenance costs, power costs, though of vital significance do not complete the entire picture. The ease of control the high degree of reliability and the general convenience of gas service should also be given consideration. They have undoubtedly contributed much toward the increasing acceptance of—perhaps it would be better to say "increasing demand" for—gas service.

The trend of equipment selection for multi-family

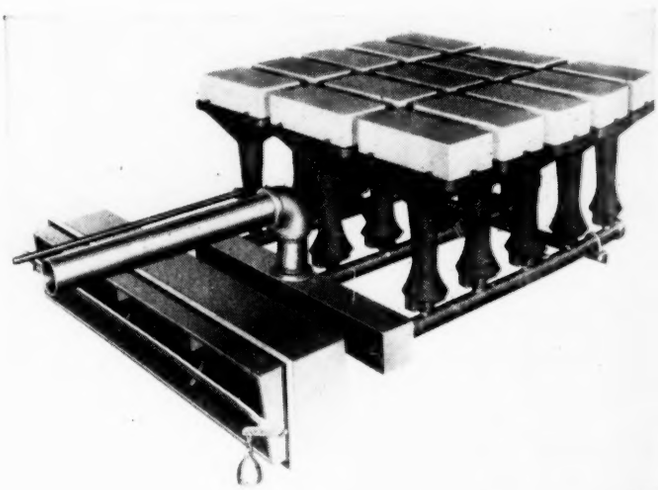


Fig. 1. Vertical atmospheric venturi burner assembly as used for low pressure gas conversions in metal firebox boilers, particularly where very quiet operation is desired.

dwellings and commercial buildings in recent years has been away from cast iron because of higher cost and other reasons. The steel horizontal fire tube boiler of modern design has replaced cast iron to a large extent. In the size range up to about 3,000 sq ft of steam, the base of such boilers extends under the entire unit and provides a relatively big combustion chamber which is well suited for coal firing but which may require additional baffling or reduction in volume when gas is used if maximum efficiency is to be developed. In the larger boilers the base does not extend the whole way under the boiler and combustion chambers are thus broader and not as long. They are frequently lined with fire brick in contrast to the water bases used in the smaller sizes. As in the case of the small steel boilers, baffles are often used to improve efficiency. When this is done the draft requirements are naturally increased, in some cases beyond the anticipated draft available from the chimney. When this is the case, and when high overloads from 150 to 200% of rating must be developed, careful selection of appropriate gas burners is essential. The choice of types is more narrowly restricted and should be confined to units producing an adequite positive combustion pressure.

Hot Water

Brief mention will be made of the possibilities of applying gas for domestic hot water supplies in the summertime, even in those places where gas might not be competitive with oil and coal on a year 'round heating basis. This in itself is not a new proposal, having received attention as far back as twenty years ago, but it now has received a new impetus because of the rapidly mounting boiler room labor costs as well as the price of oil and coal. Many cases will be found in which the building management could save operating expense by applying suitable gas equipment for summer hot water supply purposes. Such gas is readily available, often at special low rates.

Another important boiler application is the supply of 140F and 180F hot water for commercial kitchens and related facilities in hotels, restaurants, cafeterias and apartment houses. By the use of a steam boiler with adequate built-in hot water "coils" it is readily possible to provide both hot water services from a single unit. The steam heats an interchanger in the storage tank. Hot water (140F) is drawn from this storage tank through the boiler coils for 180F service to machine dishwashers, etc.

The two-temperature hot water service can also be supplied by other combinations of equipment such as booster heaters (instantaneous or storage type) or external steam heat interchangers. It is most important to be able to make an accurate estimate of the total daily hot water requirements as well as the maximum hour hot water usage and the duration of such peak loads in order to select desirable equipment for minimum first cost and best operating economy. While gas water heaters with storage tanks can handle quite large water heating loads, there is a practical limit for such equipment. The still larger jobs generally require gas boilers with heat interchangers and storage tanks.

Fig. 2. Multiple flame retention nozzle burner with individual full size venturi mixers. Originally developed for firing scotch marine type boilers with extremely low pressure gas without noise or vibration.

In the special case of apartments with stores at grade levels, the use of independent gas heating and air conditioning units for the latter should not be overlooked. Such combination units providing for both summer and winter air conditioning with a single device are particularly suitable for this class of service since the loads and the time in which they are needed may not coincide with the general building requirements. Thus, even when central boiler plants are used it may be desirable to operate the stores with individual equipment.

Gas Equipment

Since buildings of various types and sizes are being considered it seems appropriate to divide gas systems into several classifications:

(1) *Cast-iron boilers AGA approved up to 4,800,000 Btu per hr capacity.* Boilers in this classification are available from a large group of manufacturers and are built to meet the requirements of the American Standards Association as evidenced by the AGA seal of approval found on the nameplate of each boiler together with its maximum rating. These AGA ratings are measured at the boiler outlet. Boilers of this type used singly or in batteries are completely packaged units equipped with all necessary controls and safety devices. They are almost entirely used for heating rather than process steam needs.

(2) *Converted small boilers.* Most coal-fired or oil-fired boilers already in use can be successfully converted to gas firing if the condition of the boiler is satisfactory. Exceptions to this general statement are the so-called "blue sky" boilers having inadequate heating surface for gas firing. The smaller boiler types are likely to be sectional, cast-iron boilers which can be converted with burners described in paragraph (3).

(3) *Conversion burners certified by AGA.* These burners, with sizes limited to 400,000 Btu per hr input, are essentially for domestic boiler conversions.

Burners are generally though not always of the atmospheric type with single nozzle models predominating at this time. Multi-port burners are also used, the choice depending on local conditions. There are also fan air supply types designed to help in overcoming draft problems such as are encountered in down-draft type boilers and furnaces. In a great many cases, a single burner will have various acceptable Btu input ratings dependent on the size and shape of the firebox in which it is to be installed. Manufacturer's catalogs show these ratings as listed by AGA.

(4) *Large cast-iron boilers.* Since these are primarily heating boilers, the load can usually be estimated closely and will not generally be increased at a future date. When correctly sized for coal, they have more than enough capacity when converted to gas. This means that available chimney draft should be adequate considering the decreased volumetric throughput. As a result either atmospheric or power type gas burners can be successfully applied, the former predominating. Many up-shot type burners are used for this class of service.

(5) *Steel fire tube boilers.* When used only for heating in sizes up to 300 hp or 42,500 sq ft of steam radiation, the factors outlined in Paragraph (4) apply. These boilers, however, find wide use in commercial installations requiring process steam at higher pressures. This introduces the question of overloads since expansion of business without adding more boilers is a common experience. Overloads of 150 to 250% of the Steel Boiler Institute ratings are readily handled with gas, provided adequate baffles are used to maintain efficiency and adequate draft is assured. Power burner assemblies furnishing high burner head pressures afford one effective method of handling this problem independent of chimney draft. At 150% overload, the gas input can be obtained by multiplying the rated capacity of the boiler in square feet of steam radiation (S.B.I. rating) by 480.

Overloads

The percent overloads which can be developed are open to some question; technical difficulties may be partially overcome by suitable gas burner selection and installation but other factors deserve consideration. In some instances, growth of a business with no room for larger boilers has led to unavoidable increases in boiler loads beyond recommended levels. Leaving such cases out of the discussion, the recommendations of boiler manufacturers are against excessive overloads. Perhaps 200% of rating should be considered a maximum figure with 150% of rating as a preferred top level. Excessive firing rates may cause local overheating of tubes due to the formation of steam bubbles; efficiency may be impaired; additional draft will be required, the value increasing as the square of the overload; and firebrick replacement may become a serious factor.

The question of overloads is complicated by the development of "packaged boilers" in which firing rates of 5 sq ft per boiler horsepower or higher are used. Contrasted with the conventional rating of 10 sq ft per boiler horsepower, one may properly question the idea that 200% of rating is really a high loading. In any event numerous installations have been made in excess of that figure.

(6) *Conversion burner equipment over 400,000 Btu per hr input.*

(a) For some installations, multiples of smaller domestic size burners may be used. These are generally up-shot types principally applied for heating boilers or where overloads are not excessive. They are sensitive to variable draft conditions. Operation is usually all-on, all-off.

(b) Vertical atmospheric venturi burners with radiant refractory tops are widely used in multiple assemblies for firing steel firebox and sectional boilers up to about 10,000,000 Btu per hr input. These up-shot burner types are simple to install and are practically silent since the flames are spread over wide area. They are influenced by variable draft conditions and operation is usually all-on, all-off.

(c) Up-shot burners for gas pressures above 10 in. w.g., while quite similar to the burners described in Par. (b), take higher pressures which permit the use of higher inputs and therefore will take care of overloads. They are adaptable to modulating control.

(d) In-shot burners, atmospheric type, are widely used at various pressures depending on the application. They are intended for firing hot refractory settings but are not usually recommended for Scotch Marine types of boilers.

(e) Combination gas and oil burners of various types are available, choice depending on the intended service. They are usually in-shot types for low, intermediate or high pressure gas operation and standby oil firing. Some types are specially designed for firing Scotch Marine or other "cold" furnace types of boilers while others should not be used for this service.

(f) Power burner assemblies require air from a blower at 4 oz to 6 oz pressure with gas supplied to mixers at zero pressure. These burners develop higher burner head pressures and therefore positive firebox pressures, although they are not actually sealed in. Although subject to blower noise, these burners are readily adaptable to firing of all types of boilers. They operate practically independent of chimney draft. Targets of checkerbrick and spiral baffles in the final pass of fire tube boilers are usually needed to develop full efficiency at high overloads. The advantages of this type are receiving increasing recognition especially for process steam boilers.

(g) Low pressure fan operated burners, because of the lower pressures developed, are quieter than the above but are not independent of chimney draft. They are widely used in heating installations and in hot water supply boilers.

Selection of Burner Type

The brief description of the various burners shows that there is considerable latitude in the choice of type for a given installation. Perhaps the most important suggestion is to investigate the best local installations as these usually reflect sound engineering practice. The gas company can generally be most helpful in this connection. Certain types become

popular in a locality because the manufacturer is on his toes; parts are available, engineering assistance can be secured readily, the unit is efficient and easily controlled, in short, a good job means a good representative is on the job.

However, additional detail about some burners seems in order and several characteristic types will be described with the understanding that omission of others in no way implies any superiority for those discussed.

(A) *Modified venturi burners.* These have one or more modified venturi mixers with flared tips assembled in a rectangular or square casing to fit boiler firing doors.

(B) *Multiple jet burners.* Gas is discharged through a number of small orifices centered opposite openings in a refractory slab.

(C) *Register type burners.* Gas is discharged radially at an angle from a central tube and air is drawn or forced around the tube mixing with the gas at the intersection of the paths. Another form of register burner uses a vertical ring equipped with gas orifices, the air entering and mixing through the ring.

(D) *Power burner types.* These are more fully discussed elsewhere. They consist essentially of air blowers and proportioning low pressure gas inpirators supplying flame retention nozzles.

As indicated in the AGA committee report (1935) on the utilization of gas for steam generation, under proper conditions of draft, furnace construction and installation of each type burner and at a definite fixed load essentially equal high efficiencies may be secured. This condition rarely obtains and thus experience and good judgment are needed to evaluate the several pertinent factors.

Boiler ratings are set up with certain definite draft values, thus making it essential to check available chimney draft as well as breeching and boiler draft losses under the proposed loads. This is increasingly important at high ratings in view of the increase in friction losses in proportion to the square of the load. The space needed for burning the gas is thus variable, requiring due consideration in choosing a burner type. Those burners in which there is relatively little mixing of air and gas produce longer flames which consequently need more space.

Checker walls are frequently used, but increased resistance must be compensated in an appropriate manner. This is also true of spiral metal baffles used in the final tube passes or chains which are sometimes hung in vertical fire tubes.

Blower type burners use a motor driven blower which delivers air to a proportioning inspirator equipped with a zero pressure gas governor. This combination assures good proportioning and mixing of air and gas in addition to providing a high degree of flexibility. Control may be modulating or on-off. The chimney is needed only to remove products of combustion and not to provide draft and this should help keep excess air down to minimum levels under varying load conditions. However, these types of burners are dependent on continuity of electric supply since the safety controls would shut down the burner on power interruption.

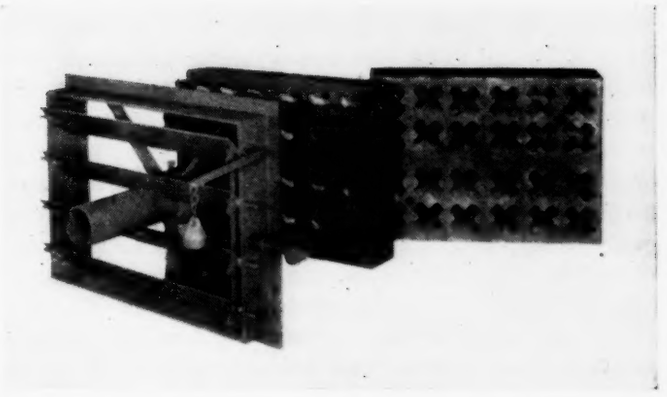


Fig. 3. Low pressure multi-jet burner. Surface of refractory serves to radiate a large share of heat release to boiler.

When gas pressures above 0.5 lb per sq in. are available, they can be effectively utilized in appropriate burner types to permit relatively high Btu release rates and to carry peak overloads. Investment costs would be somewhat lower than for blower type burners. Some engineers favor the modified venturi type burner for such service on account of greater flexibility, although practically any type can be and is used under appropriate circumstances.

Burner selection should take into account available draft and combustion space leaving margins for change during operation. This suggests a conservative approach in the matter of maximum capacities to be expected of burners. When the installation is at elevations more than 2000 ft above sea level, suitable allowances should be made. For domestic appliances the AGA Testing Laboratories reduce capacity ratings 5% for each 1000 ft elevation.

When multiple burner installations are made with the idea of shutting off some burners to carry average or light loads, precautions are advisable for the protection of burners not in use from combustion chamber radiant heat.

Choice of burner type will determine several features of burner operation, thus making it desirable to consider these points when making a selection.

(1) *Method of control.* Either all-on, all-off, or modulating control systems may be used but some burners are more desirable for the latter service than others. The "turn-down" ratio is an important factor. The method of control may affect the priming of the boiler, producing saturated steam which will cut off the amount of work that the steam will be able to do. The off-on method of control has a tendency to produce such results. The high-low method of control has a tendency to reduce over-all efficiency if the low fire position represents a substantial portion of the operating time. However, even this can be overcome by suitable means of reducing excess air in the low fire position. If, therefore, any preference could be suggested, it would be for modulating control but this statement is clearly not to be taken as a general recommendation because each case must be studied in light of its own requirements.

(2) *Noise of operation.* When low pressure atmospheric burners are used, operation is silent save for

slight sounds of ignition and shut-off. Under modulating control, there is almost no noise. On the other hand, blower noise is increasingly noticeable the higher the air pressure. Noisy boiler operation may also be caused by excessively high gas inputs which often lead to pulsation and vibration. The discussion of this latter point is given in some detail elsewhere, as it is related to the general problem of complete and safe combustion. There are numerous practical ways of curing pulsation such as changing the burner input, increasing the air supply, changing to power burners. Which of these steps to take will depend upon the circumstances surrounding each case.

(3) *Flame rod electronic protective equipment.* These are easier to apply to single pilot and single burner units than to multiple burner types. Local rules and practices may be the determining factor.

(4) *Need for standby fuel.* When this is L. P. gas, no special influence is exerted on burner selection but if oil is to be used, the burner choice becomes restricted to combination units.

The Burning of Gas

The general principles of combustion are now so well understood that it seems unnecessary to repeat details. The gases differ from the other fuels in being easier to burn, more readily controllable, and consequently there is less need for high excess air percentages. This is in turn one of the major reasons why gas burning equipment operates with such high efficiency. It is readily practical to operate units at 75% efficiency and many of the gas-designed appliances yield results of 80% or better, as measured by steam output.

With the exception of the completely premixed types of burners, most gas units are designed so as to provide only part of the combustion air as primary air. The balance is secondary air supplied around the burner flames, and a small excess is always desirable for gas boilers. As is true of all fuels, highest efficiencies would be obtained at maximum CO_2 in the flue gas (close to 12% for natural gas and as high as 17% for carburetted water gas—always use valid local values) but gas companies usually recommend burner adjustments which assure adequate excess air under all firing and draft conditions. This usually means a CO_2 concentration from 8.8% to 9.1% for natural gas as burned with typical atmospheric burners. Excess air affords good protection for safe boiler operation and control and does not lower efficiency unduly as long as the amount of excess air is kept within acceptable limits.

The use of well designed power burners may also make it practical to operate with CO_2 concentrations as high as 95% of theoretical values as such units are not dependent on chimney draft. The exact excess air required can only be determined by examination and check of the actual job. If in doubt, it is desirable to sacrifice some efficiency by using additional air or by changing to more positive type of air-gas mixing.

Table 1 shows the essential combustion data for several typical gases. It is possible to make a rough

Table 1 — Properties of Typical Commercial Gases

No.	Gas	Constituents of Gas—Percent by Volume									Specific Gravity
		CO_2	O_2	N_2	CO	H_2	CH_4	C_2H_6	Illuminants C_2H_4	Illuminants C_6H_6	
1	Natural gas (Birmingham)	...	...	5.0	...	...	90.0	5.0	...	...	0.60
2	Natural gas (Pittsburgh)	...	...	0.8	...	...	83.4	15.8	...	...	0.61
3	Natural gas (So. California)	0.7	...	0.5	...	...	84.0	14 8	...	...	0.64
4	Natural gas (Los Angeles)	6.5	...	...	...	...	77.5	16.0	...	...	0.70
5	Natural gas (Kansas City)	0.8	...	8.4	...	...	84.1	6.7	...	...	0.63
6	Reformed natural gas	1.4	0.2	2.9	9.7	46.6	37.1	...	1.3	(C_3H_6 0.8)	0 41
7	Mixed, natural and water gas	4.4	2.1	4.7	25.5	35.1	23.1	4.7	0.2	0.2	0.61
8	Coke oven gas	2.2	0.8	8.1	6.3	46.5	32.1	...	3.5	0.5	0.44
9	Coal gas (continuous verticals)	3.0	0.2	4.4	10.9	54.5	24.2	...	1.5	1.3	0.42
10	Coal gas (inclined retorts)	1.7	0.8	8.1	7.3	49.5	29.2	...	0.4	3.0	0.47
11	Coal gas (intermittent verticals)	1.7	0.5	8.2	6.9	49.7	29.9	...	3.0	0.1	0.41
12	Coal gas (horizontal retorts)	2.4	0.75	11.35	7.35	47.95	27.15	...	1.32	1.73	0 47
13	Mixed coke oven and carburetted water gas	3.4	0.3	12.0	17.4	36.8	24.9	...	3.7	1.5	0.58
14	Mixed coal, coke oven and carburetted water gas	1.8	1.6	13.6	9.0	42.6	28.0	...	2.4	1.0	0.50
15	Carburetted water gas	3.0	0.5	2.9	34.0	40.5	10.2	...	6.1	2.8	0.63
16	Carburetted water gas	4.3	0.7	6.5	32.0	34.0	15.5	...	4.7	2.3	0.67
17	Carburetted water gas (low gravity)	2.8	1.0	5.1	21.0	47.5	15.0	...	5.2	2.4	0.54
18	Water gas (coke)	5.4	0.7	8.3	37.0	47.3	1.3	...	...	...	0 57
19	Water gas (bituminous)	5.5	0.9	27.6	28.2	32.5	4.6	...	0.4	0.3	0.70
20	Oil gas (Pacific Coast)	4.7	0.3	3.6	12.7	48.6	26.3	...	2.7	1.1	0.47
21	Producer gas (buckwheat anthracite)	8.0	0.1	50.0	23.2	17.7	1.0	...	...	...	0.86
22	Producer gas (bituminous)	4.5	0.6	50.9	27.0	14.0	3.0	...	...	...	0.86
23	Producer gas (0.6 lb steam per lb of coke)	6.4	...	52.8	27.1	13.3	0.4	...	...	...	0.88
24	Blast furnace gas	11.5	...	60.0	27.5	1.0	...	...	...	...	1.02
25	Commercial butane	...	(C_4H_{10} 93.0)		...	(C_3H_8	7.0)	...	...	...	1.95
26	Commercial propane	...	(C_3H_8 100.0)		...	...	...	...	...	...	1.52

approximation by remembering that theoretically complete combustion of gas without excess air takes 10 cu ft of air for each 1000 Btu of gas burned. The products of combustion will be 1.0 cu ft of CO_2, 7.5 cu ft of nitrogen, and 2.0 cu ft of water vapor (0.048 lb per cu ft).

Each local gas utility company can supply these data for the gas which is distributed in the area in question and there may be enough difference from typcal values as given here to justify close attention to local data in making burner adjustments and flue collar or fixed damper settings.

Burner adjustments except in smaller boilers, are best made by careful checking with an Orsat analysis of the flue gases.

Combustion Space

The most frequently asked question is "How much gas can be burned in a given space?" While answers are often given to this question indicating from 30,000 to 50,000 Btu per hr per cu ft of combustion space, such answers do not tell the whole story. Examination of a large number of boilers will soon show that there are many boiler types in which far more gas than these amounts is regularly and successfully burned without any difficulty whatsoever. In fact, typical small gas-designed boilers having narrow flue passages and with relatively restricted combustion chambers burn from 100,000 to 400,000 Btu per hr per cu ft of combustion space. In extraordinary and special boiler types, even these figures would be small. Certain industrial process furnaces have been designed to burn millions of Btu per cubic foot of combustion space per hour with pressure equipment.

Hard and fast rules for combustion space cannot be used as long as so many different boiler designs are involved. The main point is to prevent overheating the firebox to the point where undue maintenance costs will result. As might be anticipated the closer the flames are to water backed surfaces, the quicker will they cool down to satisfactory levels. Flames impinging on checkerbrick target walls may cause gradual deterioration but the maintenance expense is usually justified by the over-all improvement, higher efficiency and improved flame characteristics generally being obtained. This is only a factor when using burner types requiring such accessories. The limitations affecting various burner locations arise from the need for proper secondary air distribution, for restricting flame impingement to appropriate levels (especially inner flame cones) and from the physical dimensions of the boiler. Among the other factors, the draft and the burner head pressure exert pronounced influence on the amount of gas that can be burned.

A second frequently asked question relates to the length of flames. The answer involves knowledge of the combustion chamber, the boiler draft, and the particular design of burner in question. A general answer would be that the length of the flames is related to the amount of primary air, the burner port size, and the air-gas pressure. It is also true that the rate of flame propagation of the particular gas being burned will strongly influence the flame length. The use of checkerbrick targets about 2 to 4 ft from the burner nozzles of power burners is used to control high velocity combustion.

The rate of flame propagation is a difficult property to visualize because it is the speed of burning measured perpendicular to the cone of the flame. It is not measured longitudinally or in the axis of the flame as is frequently believed. The velocity of the air-gas mixture issuing from a burner port is not a direct measure of the rate of flame propagation although a simple relationship between the two exists. The flame velocity of gases is strongly influenced by the amount of primary air and the square of its absolute temperature. Flame speeds increase as the percentage of air is increased in the mixture. The maximum rate is generally though not always slightly on the gas-rich side of the theoretically perfect combustion point. As excess air quantities are added the rate of flame propagation falls off. At 75% primary air, which is quite typical for pressure burners, the rate of flame propagation is from 85 to 90% of the maximum speed and the flames are correspondingly well defined and reasonably short.

The method of mixing air and gas as well as the thoroughness with which this is accomplished strongly influence combustion results. This will be appreciated from the preceding discussion on flames and their speeds which are, of course, dependent in great part on these very factors. The fullest utilization of modern combustion equipment capable of producing the

Table 1—(Continued)

Gas No.	Cu Ft Air Req. for Comb. of Cu Ft of Gas	Btu per Cu Ft Gross	Btu per Cu Ft Net	Products of Combustion per Cu Ft of Gas				Ultimate Percent CO_2
				H_2O	CO_2	N_2	Total	
1	9.41	1002	904	2 02	1.00	7.48	10.50	11.8
2	10.58	1129	1021	2.22	1.15	8.37	11.73	12.1
3	10.47	1116	1009	2.20	1.14	8.28	11.62	12.1
4	10.05	1073	971	2.10	1.16	7.94	11 20	12.7
5	9.13	974	879	1.95	0.98	7.30	10.23	11.9
6	5.22	599	536	1.30	0.53	4.16	5.99	11.3
7	4.43	525	477	1.01	0.64	3.55	5.20	15.3
8	4.99	574	514	1.25	0.51	4.02	5.78	11.2
9	4.53	532	477	1.15	0.49	3.62	5.26	11.9
10	5.23	599	540	1.23	0.57	4.21	6.01	11.9
11	4.64	540	482	1.21	0.45	3.75	5.41	10.7
12	4.68	542	486	1.15	0.50	3.81	5.46	11.6
13	4.71	545	495	1 04	0.62	3.85	5.51	13.9
14	4.52	528	475	1.11	0.50	3.71	5.32	11.8
15	4.60	550	508	0.87	0.76	3.66	5.29	17.2
16	4.51	534	493	0.75	0.86	3.63	5.24	17.1
17	4.61	549	501	0.98	0.64	3.70	5.31	14.7
18	2 10	287	262	0.53	0.44	1.74	2.71	20.1
19	2.01	261	239	0 47	0.41	1.86	2.74	18.0
20	4.73	551	496	1.15	0.56	3.77	5.48	12.9
21	1.06	143	133	0.22	0.32	1.34	1.88	19.4
22	1.23	163	153	0.23	0.35	1.48	2.06	18.9
23	1.00	135	128	0.17	0.34	1.32	1.82	20.5
24	0.68	92	92	0.02	0.39	1.14	1.54	25.5
25	30.47	3225	2977	4.93	3.93	24.07	32.93	14.0
26	23.82	2572	2371	4.17	3.00	18.82	25.99	13.7

desired results offers promise of increased capacity, greater operating economy and improved safety.

The technical requirements for firing gas for industrial furnaces led to a high degree of development of power gas burners with proportioning air-gas inspirators and zero pressure gas governors. This type of combustion equipment can be controlled by a single valve, the air valve, and yet the mixture of air and gas is constant over a wide range of turn-down. Burner flames are short and stable under all firing conditions as would obviously be necessary for effective industrial gas utilization. The combustion equipment produces all required draft, making a chimney flue unnecessary except to remove the products of combustion from the room in which the unit is located. It is only relatively recent that attention has been directed at the potentialities of these methods of gas firing as applied to boiler practice. Their use makes the attainment of the best possible combustion results a matter of certainty independent of chimney draft and the simplicity of control paves the way for improved safety as well.

On investigation it will be found that in all cases of practical significance the velocity of the mixture through the burner port is much greater—possibly several times as great—as the rate of flame propagation. The secondary combustion in the outer flame envelope has been shown to exert an important effect on the stabilizing flames.

The temperature of gas flames is not easy to determine under the conditions in a boiler. These temperatures have little relation to the theoretical levels attained under laboratory conditions. The reason is not hard to see since radiation from the flame to the boiler and rapid convection heat transfer reduces the temperatures sharply. It is probably fair to assume that flame temperatures in the range 1800F to 2400F will be found in boiler settings. The exact level of temperature is more of theoretical than practical interest because the heat input to burners in a boiler is fixed by load considerations and not by heat transfer relationships. Furthermore such a computation is exceedingly difficult and therefore is generally carried out only by those engaged in the work of designing gas boilers or those working with very large power boilers where the time spent on such work would be justified. Of greater importance to most engineers is the effect of excessive temperatures on brick settings.

The temperature of flue gases drops rapidly in the first part of the boiler. A significant point is that excess air reduces firebox temperatures but increases the flue gas exit temperature. Presumably the higher speed of flow of the increased volume reduces the time for convection heat transfer in the last portion of the boiler and therefore leaves at a higher temperature.

This extended discussion of the burning of gas is intended to draw attention to the need for careful consideration of draft control, choice of burner type, control of excess air, positive means for ignition, and proper pilot location.

In order to secure satisfactory performance, burner flames must be essentially stable, quiet and free from pulsation. Pulsation is a special problem traceable to periodic formation of "pockets" of partially burned gas which ignite. Causes may include lack of proper air supply and mixing, impinging of flames on cold surfaces, unventilated areas in the boiler and setting, etc. Remedies include reduction of input, substitution of power burners, changes in draft, etc. Local circumstances generally dictate the easiest solution. Flames must ignite freely under thermostatic or pressure control, particularly if all-on, all-off operation is employed. Flashback into the mixer tube is obviously objectionable as is any lifting or blowing away of the flames from the burner ports. A vital factor in this picture, therefore, is the method of ignition employed in the particular installation. This topic together with the equally important problem of draft and draft control will be separately discussed in appropriate paragraphs.

Table 2 – Incomplete Combustion of a Typical Natural Gas*

(1000 Btu per cu ft)

Per cent CO	Per cent H_2	Per cent CO_2	Heat loss due to unburned combustibles	
			Btu lost per cubic foot of gas burned	Percent loss to be added to other flue heat losses
0.5	0.5	12.0	27.5	2.8
1.0	1.0	11.8	55.0	5.5
1.5	1.5	11.5	82.5	8.2
2.0	2.0	11.0	109.5	10.9
3.0	2.8	10.0	159.0	15.9
4.0	3.8	9.5	214.0	21.4

*Perfect combustion would produce 7.5 cu ft N_2 and 1.0 cu ft CO_2. Thus dry flue gas volume would be 8.5 cu ft per cu ft of gas burned. See gas No. 1 in Table 1.

The Products of Combustion

The burning of gas produces carbon dioxide and water when sufficient air is present and when the air has been satisfactorily mixed with the gas either as primary or a combination of primary and secondary air. When these conditions are not met, combustion produces many additional products, the most important of which are carbon monoxide and hydrogen in about equal amounts. These are generally accompanied by a large number of aldehydes and other products but the total amount of these latter is so small (only a small fraction of 1%) that they can be completely neglected. In fact their only significance is their strong odor and therefore they serve as an indication that combustion is incomplete whenever their acrid presence is detected. Since the presence of CO and H_2 definitely means that combustion is not correct, immediate corrective steps should be taken; the air supply increased, the gas input reduced, the draft improved on the air-gas mixing process improved. As shown in Table 2, CO represents a loss in efficiency as well as a potential hazard and for that

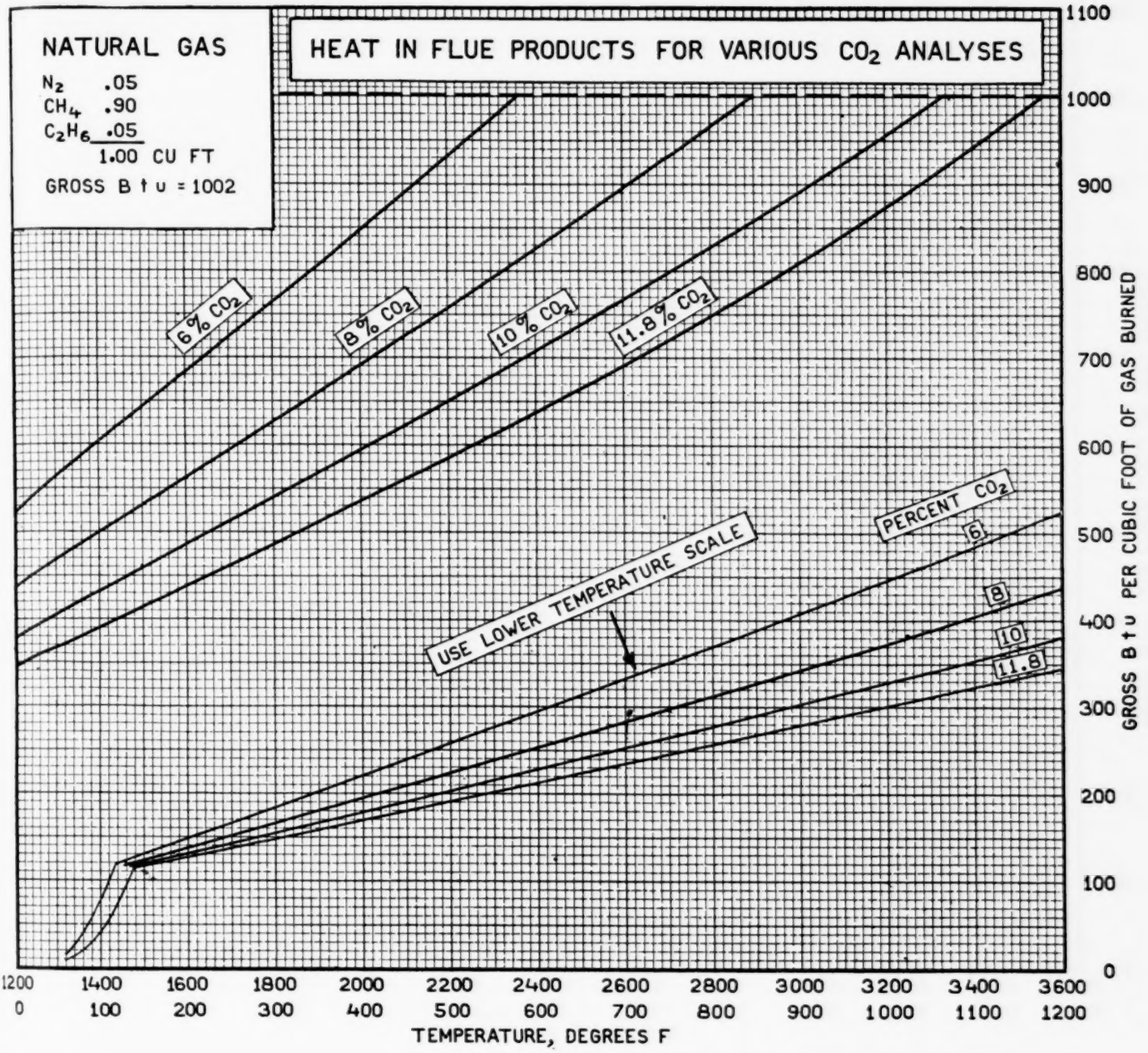


Fig. 4. Combustion Data of a Natural Gas

Cu ft dry air required for perfect combustion	9.409
Cu ft of moisture brought in by air (40% relative humidity)	0.066
Cu ft of air required for perfect combustion, including moisture	9.475
Cu ft H_2O produced for each cu ft of gas burned	2.016
Cu ft CO_2 produced for each cu ft of gas burned	1.000
Cu ft N_2 in flue gases for each cu ft of gas burned	7.484
Total volume of flue gases	10.500
Dry volume of flue gases (H_2O assumed condensed)	8.484

$$\text{Ultimate percent } CO_2 = \frac{1.0 \times 100}{8.484} = 11.79\%$$

$$\text{Dry volume of flue gases for various } CO_2 \text{ analyses} = \frac{1.0 \times 100}{\%\ CO_2}$$

Flue Gas Data Based on Burning One Cubic Foot of Natural Gas

Analysis of Flue Gases			Excess Air		Volumes of Flue Gas Constituents in Cubic Feet				
% CO_2	% O_2	% N_2	Percent	Cu Ft	N_2	O_2	CO_2	Dry Volume	Total Volume (Incl. 2.02 Cu Ft H_2O)
11.79	..	88.21	...	...	7.48	....	1.00	8.48	10.50
10.0	3.1	86 9	16.2	1.52	8.68	0.32	1.00	10.00	12.02
8.0	6.7	85.3	42.5	4.02	10.66	0.84	1.00	12.50	14.52
6.0	10.3	83.7	87.0	8.19	13.95	1.72	1.00	16.67	18.69

reason, CO_2 levels from 75% to 95% of theoretical values were suggested as a means of assuring ample but not excessive amounts of extra air supply, the exact amount depending on the various factors already discussed. Complete combustion is defined by most gas industry standards as less than .04% of carbon

monoxide in the air-free products of combustion. Good operating practice for gas equipment requires that no carbon monoxide be present in the flue gases as defined by this small quantity. In passing it may be mentioned that, valuable as Orsat analyses are in controlling boiler efficiency, they are not satisfactory for determining the presence of small amounts of carbon monoxide below 0.5%.

Small amounts of carbon monoxide can now be determined with accuracy even by inexperienced persons. The United States Bureau of Standards has developed a simple CO instrument which has been licensed for manufacture by the Mine Safety Appliance Co., Pittsburgh, and the United States Testing Co., Kansas City, Mo.

Since good gas combustion is readily attainable under practical service conditions, it is customary to plot combustion data for gas without reference to incomplete combustion. It follows therefore that a gas boiler heat balance need make no provision for unburned combustible as is commonly required for either coal or oil efficiency studies.

The efficiency of burning gas can readily be evaluated from an accurate determination of the CO_2 content of the flue gases and an accurate determination of their average temperature, the latter requiring careful attention. As frequently taken, using a mercury in glass thermometer inserted radially into the flue gas stream, observed temperatures are considerably below true value. Armed with this information it is a simple matter to refer to a typical heat content chart such as Fig. 4 to establish the amount of heat carried away by the flue products.

Data for a typical natural gas are shown accompanying the chart. For precise work, similar calculations should be carried out for the actual gas involved but for approximate purposes the typical values may be of service. Generally, detailed information for a particular gas can be secured through the local gas utility company. For the gas shown in the chart, 9% CO_2 in the flue gases would be representative of satisfactory practice with all except power burners which could be operated with higher CO_2 content. Flue temperatures of 400F would not be unusual. This data then would indicate a flue loss of 180 Btu for each cubic foot of natural gas burned, that is a flue loss of 18% of the gross heat content. This is often expressed by the term "combustion efficiency" and the value, 82%, would be considered typical.

The probability of a not inconsiderable error is also involved. Most field checks of flue gas temperature are made with an ordinary thermometer stuck in radially to the flue pipe through a small hole. The readings of such a thermometer are too low. Space will not permit any extended discussion of the reasons for this nor of the rather complex methods of obtaining the true flue gas temperature and, consequently, the true combustion efficiency. It is enough to point out that this type of data should really be used only for comparisons of relative performance.

The boiler efficiency is something else again, as has been pointed out by many authors. It may be desirable to reiterate the principal points. Boiler efficiency is less than combustion efficiency because losses other than the flue loss are also involved. Among these the most important are radiation loss and increased flue losses during periods of low fire or when the burner is off by action of its controls.

However, the low draft requirements for burning gas minimize the difference between full and part load operation, making the resultant load-efficiency curve relatively flat over a considerable portion of its length. Marked decrease in efficiency is noted when loads less than 30% of the rated boiler capacity are involved.

Most natural gases contain little or no sulfur; the odorants introducing less than one grain per hundred cubic feet of gas. Under such circumstances the products of combustion do not introduce any serious boiler corrosion (exterior metal surfaces). Such amounts of sulfur are far below levels which are encountered in the burning of coal or oil and therefore contribute to the clean furnace condition associated with the burning of gas, especially natural gas. Manufactured gases may contain from five to fifteen grains of sulfur per hundred cubic feet of gas. This is still far below the amounts in coal or oil but heating surfaces should be cleaned occasionally.

The relationship between excess air in flue products and the amount of carbon dioxide is shown in Table 3 for three typical natural gases. Data for other gases can be obtained from local utilities.

Table 3 – Excess Air in Flue Products

Percent CO_2	Natural Gas		
	A	B	C
	Percent Excess Air in Flue Products		
6	88	94	102
7	62	67	74
8	43	47	54
9	28	32	38
10	16	19	26
11	6	9	15
12	0	1	6

The difference in the natural gases is due to the varying ethane and inert content. The higher ethane percentages yield higher CO_2 content.

The types of manufactured gases are not as sharply defined today as they were a few years ago because of the widespread practice of mixing gas supplies from various sources. This is particularly true in the large cities in which coke oven gas is often the basic fuel gas, supplemented by carburetted water gas, oil gas, and liquefied petroleum gas mixed with air.

In a few cities such as Chicago, St. Louis, and Binghamton, natural gas is mixed with various manufactured gases. From the point of view of boiler operations, the kind of gas makes little difference as long as the equipment is properly selected for the gas in question. To those unaccustomed to gas fuels, a word of caution concerning the maximum percent of CO_2 is in order. Contrary to most of the other fuels for which 10% CO_2 is a good figure, some of the carburetted water gases have an ultimate CO_2 as high as

17% and boiler flue gas control must be adjusted accordingly. Table 1 shows some of the characteristic combustion constants of some of these gases. The data have not been given as extensively as for natural gas because there are fewer large installations in manufactured gas areas and there is greater variation among the gases which suggests securing local information for specific cases.

Recommendations for Burner Installation

There are now available from the American Gas Association, standard requirements for the installation of conversion burners in house heating and water heating appliances. Although these standards do not specify the size of gas burner covered, they are intended to parallel the listing requirements for conversion burners which are restricted to burners having a capacity up to 400,000 Btu per hr.

To a large extent therefore, the standards for installation are aimed at domestic boilers and furnaces, but many suggestions are of general applicability. Another source of recommendations is the AGA standard for installation of gas burning equipment in power boilers. Both of these standards undergo periodic revisions so that it is desirable to secure current copies from time to time.

The first step in any new installation is to inspect the entire heating system to determine that it is satisfactory for use with a gas burner. Apart from determining that the heating system is properly sized and installed, three important points should be carefully checked: (1) the air supply, (2) the chimney flue, (3) the boiler itself, (4) the gas supply, volume and pressure.

The Air Supply

In smaller installations, building infiltration generally supplies an adequate amount of air. If there is any doubt about the volume of air reaching the boiler room, special provisions for air should be made to the interior of the building to a point where adequate air supply is assured. Such a situation may be encounted where small or tight boiler rooms are found. An air supply opening at the floor level and at the ceiling level leading to a part of the building with an adequate air supply can readily be provided. Since no outside cold air is drawn in through such openings, they are made quite liberal. One hundred sq in. of free area per 100,000 Btu boiler input should be furnished at *each* of these two openings. When the openings are to out-of-doors they can be of smaller size, the proportions decreasing with increasing size of the equipment to a minimum of 6 sq in. for every 100,000 Btu when very large boilers are used. This is based on the principle that such larger boilers would have chimneys with increased draft so that the smaller air openings would still provide enough air supply. However, a very good guiding rule is to make the air opening at least several times the area of the vent connection. That leaves a margin of safety since the vent is carrying away about the same total weight of gases as the weight of the incoming air but in the hot expanded condition. Atmospheric burner, natural draft jobs should have an oversize outside air opening five times the flue area so that no combustion or venting troubles will arise. When power installations are involved, smaller openings are possible.

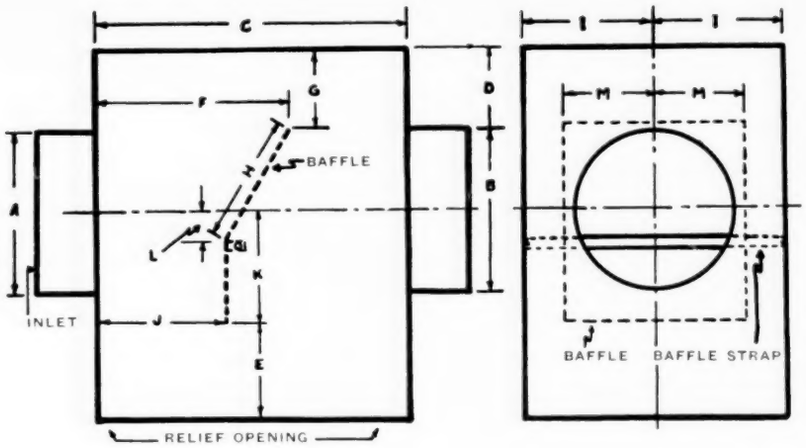
The adjustment of combustion air is important for proper safety and for maximum efficiency. Enough air must be admitted to prevent any smothering of the burner flames. Ordinarily this is not a difficult adjustment in the case of boilers such as would be encountered in multi-family installations, but it is apt to be a critical point when relatively large burners are installed in small combustion chambers. For that reason, every AGA certified conversion burner for use with boilers up to 400,000 Btu per hr input is marked with a minimum acceptable fire box dimension.

Excessive air supply will naturally reduce the operating efficiency. Therefore many installations use the "neutral pressure point adjustment." The purpose of the neutral pressure point adjustment is to permit the firing door to be opened or closed without changing the character of the flame observed with the fire door open. With atmospheric injection type burners the neutral pressure point should be between the limits of 1 in. below the firing door latch and 1 in. below the top of the firing door.

A neutral point adjuster should be inserted so as to close the flue progressively, while operating with the firing door cracked open one-eighth of an inch. A lighted match is used to locate the neutral point since the flame will be blown outward above the neutral point and will be drawn in below it. When this has been completed a further check should be made of the burner flame characteristics. The unit should be allowed to operate for about half a minute and the firing door quickly opened to see if there is any evidence of improper flames, in which case further adjustment is required. In the case of larger installations a flue gas analysis will probably be made but the CO_2 percentage should not exceed the recommendations previously suggested. The local gas company will be glad to offer help in this connection. The wider range of manufactured gas types makes it impractical to give a definite figure for CO_2 content but this can always be secured from the local gas company. A further check should be made after additional operating time has elapsed to be certain that the products of combustion are being properly removed by the chimney. This can readily be ascertained by holding a match or taper to the relief opening of the draft hood. If adjustment is not correct, the flame will be extinguished by escaping products and should this be the case the burner should not be placed in operation until the situation is corrected by proper repair or adjustment.

The Chimney Flue

A careful inspection of the chimney flue is essential. The size as well as the condition of the vent piping or breeching and the chimney flue should be such that satisfactory operation with gas is assured. The former may require replacement either because of rusting or improper sizing. If the chimney flue is too



DIMENSIONS, INCHES

Hood Size	A	B	C	D	E	F	G	H	I	J	K	L	M
7	7	7	14	3½	4¾	8¾	3⅜	5⅞	5⅞	5⅜	5	1 5/16	4 11/16
8	8	8	16	4	4¾	10	3⅜	6 11/16	6 11/16	6 11/16	5⅜	1½	4 11/16
9	9	9	18	4½	4¾	11¼	4⅜	7½	7½	7½	6⅜	1 11/16	5¼
10	10	10	20	5	4¾	12½	4⅜	8⅜	8⅜	8⅜	7	1⅞	5 5/16
11	11	11	22	5½	4¾	13¾	5⅜	9⅜	9⅜	9⅜	7⅜	2 5/16	6⅜
12	12	12	24	6	4¾	15	5⅞	10	10	10	8½	2¼	7

Fig. 5. Suggested dimensions for a horizontal draft hood.

small, appropriate steps to remedy or overcome this fact are indicated.

The use of the draft hood is required on all AGA approved gas designed boilers since they are intended to operate without chimney draft. The purpose of the hood is to protect the boiler and to remove the flue products at the same time interrupting the chimney draft. The draft hood is also required on coal boilers up to 400,000 Btu input converted with conversion burners which are intended for operation without chimney draft. Draft hoods, as shown in sketches, Fig. 5, 6, and 7 are available for vertical or horizontal operation. These and other acceptable hoods are covered in ASA Code Z21.12-1937.

The conditions under which the draft hood is not required are more difficult to define since the draft hood provides safe venting in event of down draft, flue stoppage or poor draft. Installations designed to require definite draft through the boiler such as are encountered in large boilers, especially the fire tube and Scotch Marine types, need the unbroken flue connection with a balanced draft tee or other means such as automatic positioning damper to adjust the actual draft values to the desired values.

For up-draft boilers, the flue size is made the same as the outlet size of the boiler flue collar. For those up-draft boilers in which a decrease in flue size may be permissible, the data in Table 4 are applicable.

It is then essential that the chimney flue can be relied upon to furnish adequate draft at all times. The following conditions must be met:

(1) Adequate height and diameter,
(2) Clear and unobstructed flue,
(3) Termination clear of roof, parapet, or nearby structures,
(4) Flue temperature sufficiently high,
(5) May require use of balanced draft regulator or one of the new controlled draft dampers.

The size and height of the chimney in relation to its capacity for handling natural draft burners can be found in the appropriate charts. One is used when a draft hood is employed while the other is for use in solid connected boiler jobs.

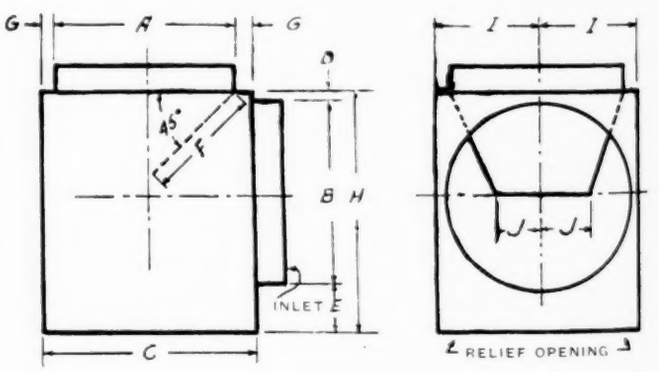
Proper selection of vent pipe and chimney flue sizes will prove of material advantage in securing efficient boiler operation. Experience has shown that a lack of attention to these details may result in troublesome draft conditions which may be bad enough to interfere with proper operation or at least cause high operating cost because of inefficiency.

Table 4 — Draft Hood and Flue Pipe Sizes for Up-draft Boilers

Flue pipe loadings for boilers of the sizes shown shall not exceed 6500 Btu burner input per hour for each square inch of flue area.

Burner Input, Btu per Hour	Draft Hood and Flue Pipe Diameters, Inches
Up to 120,000	5
120,000 to 160,000	6
160,000 to 250,000	7
250,000 to 320,000	8
320,000 to 410,000	9

NOTE: If the flue pipe length exceeds 10 ft, the next larger size should be used.



DIMENSIONS, INCHES

Hood Size	A	B	C	D	E	F	G	H	I	J
7	7	7	8	½	1 ¾	4 1/16	½	9¼	4	1 3/8
8	8	8	9	½	2	5 5/16	½	10½	4½	1 9/16
9	9	9	10	½	2¼	6	½	11¾	5	1¾
10	10	10	11	½	2½	6 11/16	½	13	5½	1 5/16
11	11	11	12	½	2¾	7 5/16	½	14¼	6	2⅛
12	12	12	13	½	3	8	½	15½	6½	2 5/16

Fig. 6. Suggested dimensions for a horizontal-to-vertical draft hood.

The size of the vent pipe connection or smoke breeching as it is called in the case of large units should be the same size as the outlet collar on the boiler in question. A rough rule of thumb is to use 1 sq in. of area for each 65,000 Btu per hr.

Chimney diameters are shown in Table 5 but the sizes are subject to variation depending on the length of horizontal breeching, the presence of offsets, flue temperature and other factors.

Table 5 — Suggested Chimney Diameters

Btu Input per Hour	Height 100 Feet	Height 50 Feet
	Diameter, Inches	
When No Draft Hood is Used		
1,000,000	7	8
2,000,000	10	11
4,000,000	13	14
6,000,000	16	17
8,000,000	18	19
10,000,000	20	21
When Draft Hood is Used		
200,000	7	7
400,000	9	10
600,000	11	12
800,000	12	13
1,000,000	13	15
1,500,000	16	17

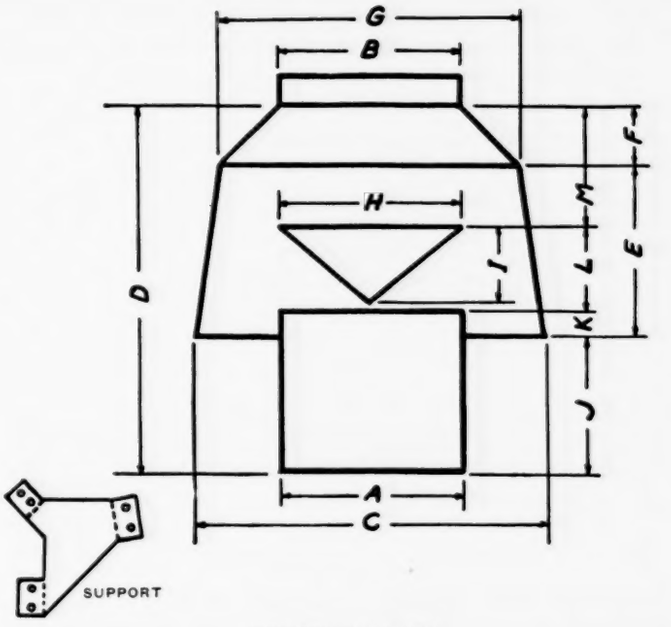
When chimney flues of the required sizes are not available, it is evident that a mechanical venting system must be used. These usually are exhausters, although inspirators installed at the base of the stack have also been used. In any case, suitable electric interlocks are necessary to provide positive ventilation before allowing the gas to come on. It will also occur to many that exhausters could readily be sized large enough to furnish motive power to overcome boiler friction as well as serving to correct chimney conditions. Such systems are occasionally used but they increase the likelihood of air leakage through the boiler with attendant loss of efficiency. Positive pressure burner systems, on the other hand, make the discovery and correction of leaky spots relatively simple.

When power burners are used, the installation no longer depends on chimney draft, consequently permitting much greater loads on chimneys of a given size. The limits would have to be determined by the engineers making the installation since the available burner pressure is partially absorbed by burner target checkerbrick and flue passage baffles in addition to the normal friction through the boiler. Such burners do, however, offer a ready solution to situations where unfavorable chimney conditions are encountered.

The Boiler

The inspection of the boiler and its firebox is a self-evident step before deciding whether to install gas at all. Obviously warped or broken-down boilers or over-age boilers, particularly in hard water territory, represent typical situations in which replacement must precede the use of gas. This is also true of undersize boilers although over-firing may be a practical solution; this step requiring experience and good judgment in the selection and installation of burners.

Mention of over-firing rates suggests a word of caution, experience having shown that boiler room operators seem to acquire a pride in claiming higher and higher fuel inputs. It is most advisable to make an actual check of the maximum firing rate in relation to the S.B.I. rating of the boiler. In most heating installations (as distinct from combination heating and process steam jobs) the capacity of the boiler when using coal is greater than needed with gas. Reduced firing rates should therefore be expected when gas is applied since it is an automatic fuel. When this is the case, excellent efficiencies can be developed. Even when some additional capacity over the S.B.I. rating is needed, no difficulty should be anticipated and the usual installation would be one of atmospheric type burners. The less frequent case of high overload capacity, however, may require higher burner inputs and consequently, more firebox pressure than is available from low pressure atmospheric burners.



DIMENSIONS, INCHES

Pipe Size	A	B	C	D	E	F	G	H	I	J	K	L	M
7	7	7	13.5	13.9	6.4	2.3	11.6	7.0	2.9	5.3	0.9	3.1	4.6
8	8	8	15.5	15.8	7.1	2.7	13.4	8.0	3.2	6.0	1.0	3.5	5.3
9	9	9	17.5	17.5	7.7	3.1	15.2	9.0	3.5	6.7	1.0	4.0	5.8
10	10	10	19.7	18.8	7.9	3.6	17.2	10.0	3.8	7.3	1.0	4.3	6.2
11	11	11	22.2	20.7	8.4	4.3	19.6	11.0	4.1	8.0	1.5	4.6	6.6
12	12	12	24.7	22.2	8.7	5.0	22.0	12.0	4.4	8.5	1.7	5.0	7.0

Fig. 7. Suggested dimensions for a vertical draft hood.

Protective Equipment and Pilots

Ignition of gas boilers is accomplished by means of one or more gas burners (pilots) which are independent of the main burners. These pilots in turn may be

ignited by spark or by a hand gas torch of suitable design.

In the case of burners up to 400,000 Btu pr hr covered by the American Standard Listing Requirements for Conversion Burners, pilots are essentially those used for domestic types of gas appliances. These are not considered satisfactory for larger installations because of the slower response of the controlling elements.

Larger boilers require the fast action of flame rod combustion safeguards although a recently introduced flue gas analyzer type of combustion control offers promise of another effective means of protection. The proper care as well as the correct initial installation of all protective devices is essential for their safe functioning. Various requirements may be involved and should be met. The local utility company is generally the best source to consult on these points.

Three general methods of ignition of safety pilots can be installed, the choice depending partly on local preference and partly on the presence or absence of a boiler room attendant.

(1) A grounded hand torch may be inserted at the location provided for the purpose at the pilot. The torch flame plays on the flame rod, energizing the pilot gas valve thus permitting gas to flow to the pilot. The pilot flame takes over and the torch may be removed. The main gas burner is then ignited. This system is also used without any pilot burner, Fig. 8, in which case it is the main burner valve that opens when the flame rod circuit is closed by using the grounded hand torch.

(2) A push button may be used to actuate a conventional spark plug or equivalent at the pilot, Fig. 9. Pressing the button also allows the temporary flow of pilot gas. After the pilot flame is ignited the safety circuit through the flame rod is energized and the main burner is ignited.

(3) Automatic ignition starts with a purge time period to be certain that the boiler is clear of combustible gases. When purging is completed, a spark is automatically started and gas flows to the pilot burner. After a short time, the spark is turned off and the flame rod supervises safe operation.

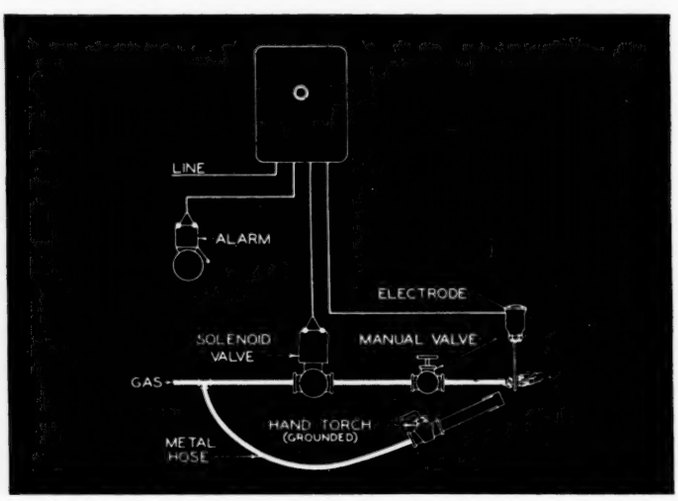


Fig. 8. Ignition system. Hand torch and flame rod actuate main gas valve. No intermediate pilot used.

Particularly in the case of multiflame burners the question of "how many pilots" arises. Whenever practical, each main burner should have a continuously burning pilot burner. However, groups of vertical burners having one pilot for each group have proved to be satisfactory.

Some utility companies prefer to limit the use of the fully automatic ignition systems to boilers up to about 100 hp size suggesting lighting by the boiler attendant for larger units. In any event, the flame safeguards should be of a type which will shut off the gas within at least five seconds after flame failure.

After ignition, it is the main burner flame which should be supervised by the protective device rather than the pilot flame exclusively. If electric power fails the entire gas supply should be shut off.

To summarize; the purpose of automatic safety shut-off unit is to control the safe use of gas. When the electric valves are in operation, they are held open when the circuits are energized but close automatically when de-energized. They are used in both the main burner and pilot burner gas supply piping to shut off gas during idle periods or in the event of unsafe operating conditions. Their purpose is to protect the system against interruption in various services and operations, flame failure, electric power or gas failure, excessive steam pressure, low water and other hazards. Such valves must necessarily be of a type which cannot readily be by-passed or blocked in an open position whether they are designed for automatic or manual operation.

All controls and regulators should be tested by operating them a sufficient number of times to be certain that the cycle of boiler operations is proceeding in the proper manner. Such inspection at the time of installation is almost a foregone conclusion but it should be repeated with sufficient frequency to assure reliable operation of safety equipment at all times. Careful attention should be given to manufacturers' instructions, particularly with respect to the frequency of change of electronic tubes in flame conductivity and similar protective mechanisms.

D. A. Campbell in his paper in *Instruments*, December, 1945, gave some pertinent suggestions regarding safety pilots which are well worth consideration:

(1) "Don't attempt to install a pilot and protective unit requiring secondary air in a combustion chamber where no secondary air is available or where the chamber is under more than atmospheric pressure.

(2) "Don't attempt to use a thermal expansion or thermoelectric type unit where immediate shut-off is desirable because the lag introduced by ambient temperature may slow such an operation down to as long as five minutes, during which time considerable fuel can accumulate in the chamber.

(3) "Keep in mind that electric equipment will not operate properly if subjected to serious moisture conditions. This is particularly true of electronic equipment, such as used in flame failure equipment, where even a slight moisture film may cause the equipment to operate unsafely by causing current leakage which imitates flame conditions.

(4) "Don't assume that you know more about the installation than the manufacturer of the equipment

and attempt to shortcut his installation requirements. Each item of his requirements has been carefully developed to meet a definite hazard and you cannot expect correct operation unless you install the equipment according to his directions.

(5) "Particularly in the case of electrical equipment, it is necessary that proper voltage be applied, as under-voltage may prevent valves from opening when they should and over-voltage may cause them to remain open when they should close.

(6) "No system will operate safely without satisfactory accessory equipment, so be sure that such parts of the installation as solenoid valves, relays, pilots and wiring are not only the best procurable but kept in good condition.

(7) "In case of difficulty in operation don't condemn the equipment until you have really eliminated all the possible sources of trouble outside of the equipment. After a good many years of experience using electronic protective equipment on gas-fired units, I can truthfully say that the number of cases in which the equipment itself was actually at fault were so few I could count them on the fingers of one hand.

(8) "No flame-failure protective device yet developed will do more than check one flame at any particular moment. This means that multiple burners which will not immediately light from one to the other require a separate unit for each burner. There have been developed systems with rotating switches using a number of sensing electrodes with one flame-failure relay. These tend to be complicated and difficult to maintain, but are being improved continually."

Plain Pilots and Hand Torches

Many installations will have a plain pilot in addition to the protected pilot. Such a plain pilot should conform to the following general recommendations:

(a) Should have a flame retention nozzle and be supplied by a short venturi mixer.

(b) Should stay lighted under all operating conditions such as: pulsation, maximum draft, opening and closing of dampers, sudden closing of main burner control valve.

A hand lighting torch should be made in a similar manner and it should certainly be tried under the most severe conditions to be certain that it will operate as desired. The hand torch must be electrically grounded so that its flame can complete the flame rod circuit allowing gas to flow to the burners until they are safely lighted.

On-Off vs. Modulating Control

Although each method of boiler control has its special field of usefulness, many installations are made on the basis of local preferences. From the standpoint of developing optimum efficiency, it might be advisable to use the on-off control for jobs in which the load itself is intermittent or which have intermittent demands. Under on-off control excess air flow through the boiler will be at two definite levels; during the on-period when maximum flue product flow occurs, excess air will be at the desired low level, say

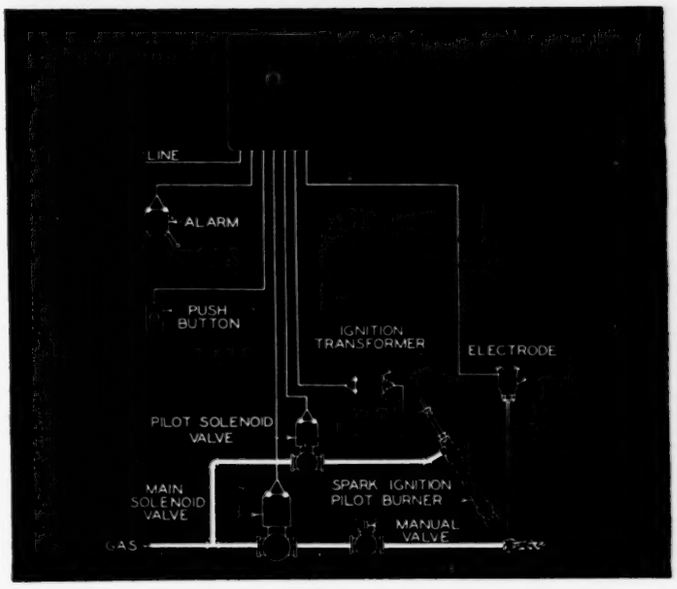


Fig. 9. Ignition system. Push button actuates pilot solenoid and spark. Flame rod takes over and actuates both pilot and main solenoid.

approximately 25%; during the off-period air flow will depend on residual chimney draft which produces a minimum flow. Efficiency during operation will be at high levels although over-all results will be influenced by the ratio of time-on to time-off.

When the load involves relatively high though short time overloads, burner controls based on sectionalizing burners are often used. Two or more groups of burners are connected for independent operation under their own controls. Stack control is desirable to prevent great increase in over-ventilation when only a single burner group is in operation.

Modulating control systems are very popular, probably constituting a majority. They are suitable for both heating and process steam boilers, particularly where the load itself is modulating in character.

Attention is directed at the desirability of controlling excess air when modulating. Various arrangements for maintaining reasonably constant air-gas ratios have been devised, new and improved models being field tested at this writing.

Gas Piping

Specifications for gas piping should require that it be constructed and installed so as to be durable, substantial and gas tight. The most common material for house piping is wrought iron and wrought steel with malleable iron pipe fittings. Cast iron pipe fittings and aluminum tubing are not permitted for main gas pipes. Table 6 shows the specifications for threading pipe.

The size of gas pipe depends upon the following factors:

(1) Maximum gas consumption

(2) (a) Length of pipe and (b) the number of fittings

(3) Allowable pressure drop from the meter—generally, though not always, 0.3 in. w.g.

(4) Specific gravity of the gas.

Table 6 — Specifications for Threading Pipe

Nominal Size of Pipe, Inches	Approx. Length of Threaded Portion, Inches	Approx. Number of Threads to be Cut
¾	¾	10
1	⅞	10
1¼	1	11
1½	1	11
2	1	11
3	1.63	13
4	1.73	14
5	1.84	15
6	1.94	15

Table 7 which is based on 0.3 in. pressure drop furnishes the capacity of different sizes and lengths of gas pipe in cubic feet per hour. The low pressure drop makes the allowance for the ordinary number of fittings required for piping, permitting Item 2 (b) to be ignored.

To convert the figures given in Table 7 to capacities for another gas of different specific gravity, multiply the tabular values by the multipliers in Table 8.

Although the gas flow tables are usually adequate to select pipe sizes, it is sometimes necessary to determine capacities under conditions other than shown in tables. The following equations can be used:

(a) For gas pressures not exceeding one pound per square inch gage

$$Q = 3550\,K\sqrt{\frac{h}{SL}}$$

(b) For gas pressures exceeding one pound per square inch gage

$$Q = 4830\,K\sqrt{\frac{Pa}{SL}}$$

Where:

Q = cubic feet per hour
h = pressure drop expressed as inches of water
S = specific gravity referred to air = 1.0
L = length of pipe in feet
P = pressure drop expressed as pounds per square inch
a = average absolute pressure in pipe in pounds per square inch

$$K = \sqrt{\frac{D^5}{1 + \frac{3.6}{D} + .03D}}$$

Where D is inside diameter of pipe in inches.

Values of K for various pipe sizes are:

Pipe Size	K
1½	1.81
2	3.67
3	10.95
4	22.91
6	67.97
8	138.5
10	246.7

Table 7 — Pipe Capacities

Length of Pipe, Feet	Nominal Diameter of Pipe, Inches							
	¾	1	1¼	1½	2	3	4	6
	Capacity, Cubic Feet per Hour (For a 0.6 Sp. Gr. Gas and Pressure Drop of 0.3 in. w.g.)							
15	218	440	750	1220	2480	6500	13880	38700
30	155	320	535	850	1780	4700	9700	27370
45	124	260	435	700	1475	3900	7900	23350
60	119	226	380	610	1290	3450	6800	19330
75	97	200	345	545	1120	3000	6000	17310
90	88	180	310	490	1000	2700	5500	15800
105	80	168	285	450	920	2450	5100	14620
120	...	158	270	420	860	2300	4800	13680
150	...	140	242	380	780	2090	4350	12240
180	...	128	225	350	720	1950	4000	11160

Table 8 — Multipliers for Various Specific Gravities

	Specific Gravity (Air = 1)													
	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90
Multiplier.....	1.55	1.42	1.31	1.23	1.16	1.10	1.04	1.0	.962	.926	.895	.867	.841	.817

Every installation should have a main, hand operated, lever type, shut-off valve. Gas for pilots should be connected ahead of this control valve so that the pilot may be turned on manually without turning on the main supply of gas. For all except the smaller boilers, the manual valves should be of the lubricated plug type.

GAUGES OF SHEET METAL FOR ALUMINUM AND STEEL DUCTS

The recommendations which follow are from the Report of the Committee on Air Conditioning, National Fire Protection Association, and reprinted here by permission.

Rectangular Ducts[1]

(For Round Ducts, see Footnote)

Max. Side, Inches	Aluminum B & S Gauge[5]	Steel, U. S. Std. Gauge	Type of Transverse Joint Connections[2]	Bracing
Up to 12	24	26	S-drive, pocket or bar slips, on 7 ft. 10 in. centers	None
13 to 24	22	24	S-drive, pocket or bar slips, on 7 ft. 10 in. centers	None
25 to 30	22	24	S-drive, 1 in. pocket or 1 in. bar slips on 7 ft. 10 in. centers[3]	1 x 1 x ⅛ in. angles, 4 ft. from joint
31 to 40	20	22	Drive, 1 in. pocket or 1 in. bar slips on 7 ft. 10 in. centers[3]	1 x 1 x ⅛ in. angles, 4 ft. from joint
41 to 60	20	22	1½ in. angle connections or 1½ in. pocket or 1½ in. bar slips with 1⅜ x ⅛ in. bar reinforcing	1½ x 1½ x ⅛ in. angles, 4 ft. from joint
61 to 90	18	20	1½ in. angle connections or 1½ in. pocket or 1½ in. bar slips 3 ft. 9 in. maximum centers with 1⅜ x ⅛ in. bar reinforcing	1½ x 1½ x ⅛ in. diagonal angles or 1½ x 1½ x ⅛ in. angles, 2 ft. from joint.
91 and up	16	18	2 in. angle connections or 1½ in. pocket or 1½ in. bar slips 3 ft. 9 in. maximum centers with 1⅜ x ⅛ in. bar reinforcing[4]	1½ x 1½ x ⅛ in. diagonal angles or 1½ x 1½ x ⅛ in. angles, 2 ft. from joint

[1]For normal pressures and velocities utilized in typical ventilating and air conditioning systems. Where special rigidity or stiffness is required, ducts should be constructed of metal two gauges heavier. All uninsulated ducts 18 in. and larger should be cross-broken. Cross-breaking may be omitted on uninsulated ducts if two gauges of heavier metal is used.

[2]Other joint connections of equivalent mechanical strength and air tightness may be used.

[3]Duct sections of 3 ft. 9 in. may be used with bracing angles omitted, instead of 7 ft. 10 in. lengths with joints indicated.

[4]Ducts 91 in. and larger require special study for hanging and supporting methods.

[5]Aluminum, cadmium plated, zinc coated or other approved non-corrosive material for hardware or fastenings (sheet metal screws, rivets, nuts, bolts, etc.) should be used in fabrication and erection of aluminum duct work.

NOTE. Round ducts should be constructed of metal of the same gauge as specified for rectangular ducts of the same cross-sectional area, e.g. a round duct up to 13 in. dia., should be of 26 U. S. Standard gauge for steel, 24 B & S gauge for aluminum, up to 33½ in. dia., should be 24 U. S. Standard gauge for steel, 22 B & S gauge for aluminum and up to 67½ in. dia. should be 22 U. S. Standard gauge for steel, 20 B & S gauge for aluminum.

Rectangular Warm Air Ducts

(For Round Ducts, see Footnote)

Type	Width, Inches	Min. Wt. of Tin	Min. U. S. Gauge, Galv. Iron	Min. B&S Gauge, Aluminum
Not Enclosed in Partitions	Under 14	—	30	26
	14 or over	—	26	24
Enclosed in Partitions	Under 14	1C(107lb)	30	26
	14 or over	1X(135lb)	28	26

NOTE. For round ducts not enclosed in partitions: Under 12 in. dia., 1C(107lb) min. wt. of tin, or 30 U. S. gauge galvanized iron, or 26 B & S gauge aluminum; 12 in. or over diameter, 1X(135lb) tin, 28 U. S. gauge galvanized iron, or 26 B & S gauge aluminum.

DETERMINING AMOUNT OF EXCESS COMBUSTION AIR

The excesss air supplied to a combustion process over that theoretically required can be calculated from the data from a flue gas analysis.

The formula is

$$\text{Percent excess air} = \frac{O_2 - 1/2\ CO}{.266N_2 - (O_2 - 1/2\ CO)}$$

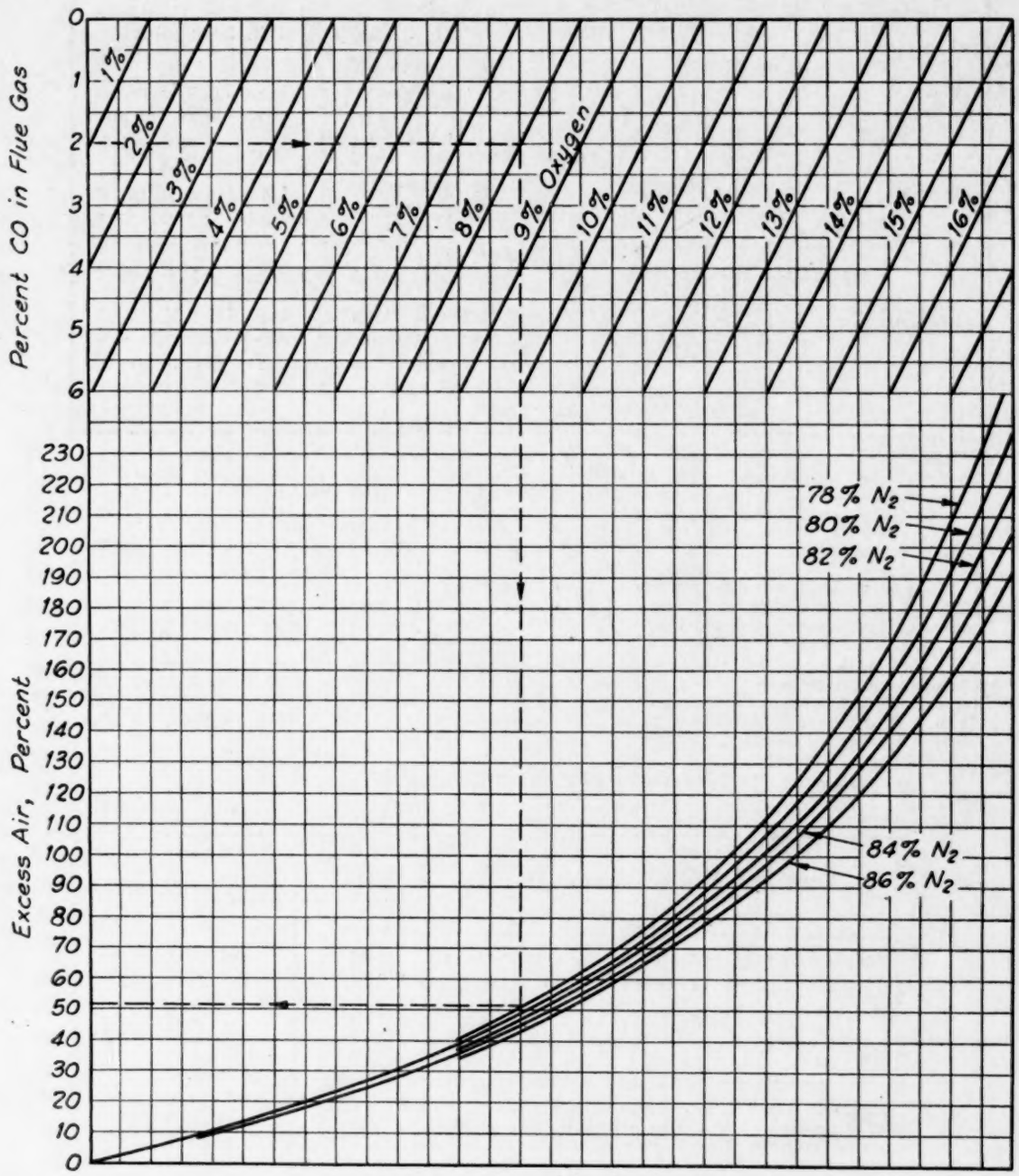
where O_2, CO, and N_2 are the percent of oxygen, carbon monoxide and nitrogen from the flue gas analysis expressed as a whole number.

The accompanying graph is a solution of this formula. Enter at the upper left CO scale, more to the right to the desired O_2 curve, drop vertically to the proper N_2 curve, thence left and read the excess air.

The graph applies to any fuel with a low nitrogen content, so that it can be used for coal or oil but not without error for high nitrogen gases.

Example. A flue gas analysis shows 2% CO, 12% CO_2 and 8% O_2. How much excess air is being supplied?

Solution. The sum of CO, CO_2 and O_2 is 22% so that by difference the N_2 in the flue gas is 78%. On the upper left scale locate 2% CO, move horizontally to the 8% O_2 line, drop to the 78% N_2 line, left to the excess air scale and read 51%. The formula itself gives 50.8%.



A Material for INDUSTRY

Finned Coils for Radiant Heating

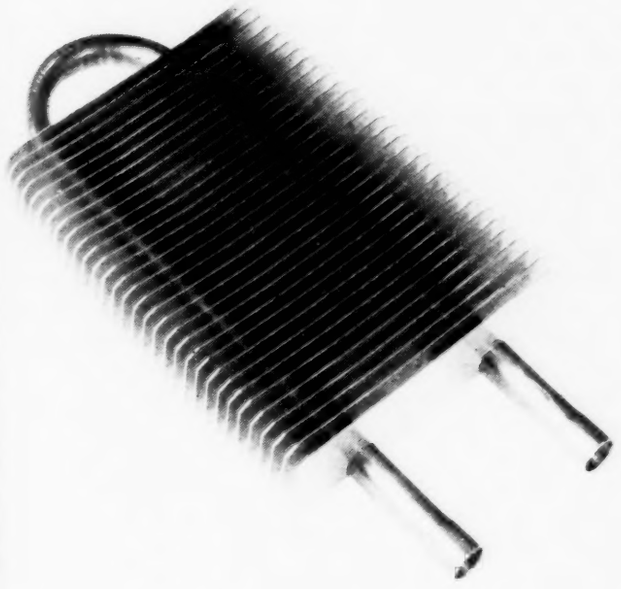
A NEW method of heating panel surfaces for radiant heat installations is available with the use of Kritzer radiant coils consisting of standard sections of tubing with fins. Instead of heating ceiling, walls or floor with imbedded tubes or piping, the enclosed areas behind them are heated with the finned copper tubing carrying the hot water from the boiler. Air in the spaces enclosed by joists, flooring and plaster for ceiling installations, circulates through these finned sections, is heated, and in turn heats the panel surfaces. Coils can also be placed between studs in walls.

Short finned sections of coils are mounted between each pair of joists or studs. The entire finned area is open to the air of the enclosed space.

Coils are constructed of two parallel runs of ⅝ in. copper tube on 3 in. centers to which are mechanically bonded aluminum fins 1½ in. x 6 in. These coils are sold in standard lengths of approximately 10 ft with finned sections to fit 12, 16 and 24 in. joist or stud spacings. This standard coil can provide radiant heating for the entire house as it can be used in either ceiling, floor spaces, or wall spaces.

When the framing of the house has been completed and before the interior walls are erected, these coil lengths are installed in courses extending crosswise to the joists from one end of the house to the other. Every joist space will have a finned section. These courses of coil will start approximately 12 to 18 in. from the side walls and will be placed on centers varying from 5 ft to 12 ft apart—depending on the heat requirements of the particular job, outside design factors, etc.

Ceiling installation of coils, showing the two-inch furring strips placed crossways to the joists and below finned coils. Ceiling is suspended below the strips.

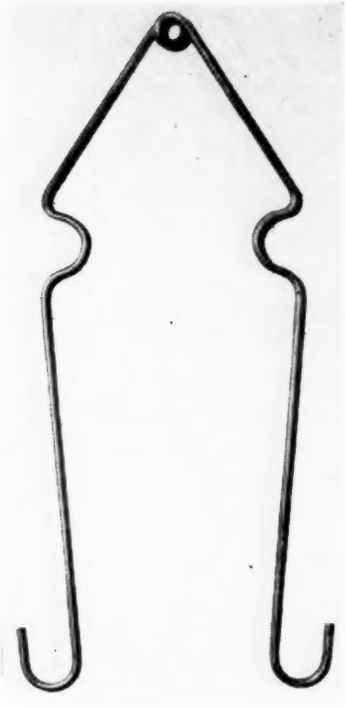


Return bend section placed at the end of the finned tube run. Ends are belled to facilitate joining with tube of the next section.

Supplementary heat for unusual exposures, picture windows and bathrooms is provided by extra courses of coil at those locations, either in the ceiling or in the wall surfaces adjacent thereto.

Installation of these coil courses is basically simple. A chalk line gives the placement position. Special hangers are nailed to every fourth joist with the red head of the hanger even with the joist bottom. The coil courses are then placed in the lower claws of the hanger and the coils adjusted to fit the entire series of spaces. One end of each coil is belled so that it can be sweat connected to the ends of the next section without the use of sweat fittings. Solder rings are placed on each bell, heat applied, and the entire coil joint soldered. The coil course is then raised to its permanent position on the hanger. The welding position claws are bent upwardly locking the coil in a free swinging support that permits of expansion or contraction of the coil length without binding or wood squeaking during the period of heating or cooling.

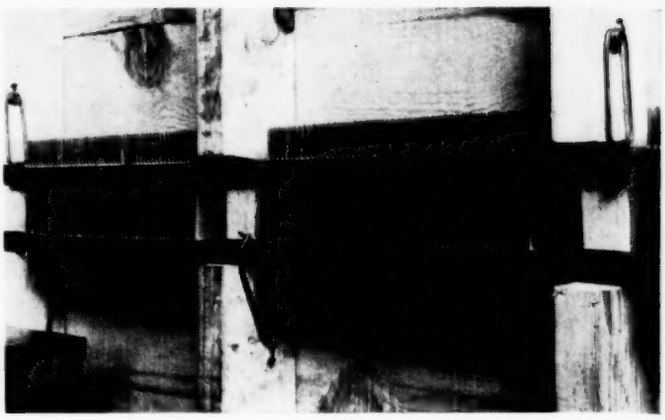
To keep the coil courses above the ceiling construc-



Special pipe hanger for the coils.

tion, 2 in. x 2 in. furring strips are applied crossways to the joists and the ceiling applied to the strips. This permits a space of approximately 1½ in. below the tubing and the fins.

Zone control is achieved by operating different feed and returns from a manifold at the pump. Because fins are used to provide the main heat transfer, short runs of tubing are the rule. The limit per circuit is arbitrarily set at 120 ft which because of supply and return lines means 60 lineal feet of Kritzer coil. Four or five such circuits, each supplying water at one-half gpm are considered by the manufacturer to be more than ample for the average home. With the small number of circuits and the short travel of water, the problem of balancing out the various circuits is claimed to be practically eliminated.



Coils placed in a wall installation. Only the top sections of the special pipe hangers were used.

The entire permanent installation can be made at one time during the house construction with no interference or waiting for other trades. The manufacturers claim two reasonably competent mechanics can install the entire radiation for an average house up to the pump manifold in four to six hours.

With small water volumes involved, the time lag inherent with heavy surfaces is eliminated, and the heating panels will follow heating requirements much faster. Where freeze-up conditions prevail, an antifreeze preparation can be added to the water in the system at low cost. Coils are made by Kritzer Radiant Coils, Chicago, Ill.

CO Exposure in Auto Repair Shops

Thirty-three auto repair shops in Blair County, Pa., were studied during the winter of 1947-48 by the Bureau of Industrial Hygiene of the Pennsylvania Department of Health in order to determine the extent of carbon monoxide exposures. A brief report was given in a recent issue of *Industrial Hygiene Newsletter*, from which the following is taken:

The investigation disclosed that the general ventilation of the majority of the garages was poor and that in only a few instances was adequate exhaust ventilation provided. Tests for carbon monoxide in the air of the workroom indicated the effectiveness of adequate exhaust ventilation where installed, for it was found that under such conditions the atmospheric concentrations of carbon monoxide were below 100 parts per million of air—the maximum safe limit for exposure to this gas during an eight-hour day, as recommended by health authorities.

Where adequate ventilation was not supplied, the concentrations of carbon monoxide under conditions representing a peak work load were high. A man working at a distance of three feet from the exhaust pipe of a car with motor running was found to be exposed to 1,400 parts of carbon monoxide per million parts of air. Such an exposure could be dangerous to life after 30 minutes and perceptible effects would be noted after about 15 minutes. In several instances, concentrations of carbon monoxide in excess of 400 parts per million of air for periods over one hour were encountered. Such exposures are not conducive to good health and should be avoided, according to the study that was reported.

In the group studied there were 10 garages that had installed ozone generators and investigation disclosed that there was no difference in the amount of carbon monoxide in the garage when the unit was turned on or when it was turned off. Obviously, the results of the test indicate the inadequacy of the ozone units in eliminating the carbon monoxide hazard in garages, and other control measures must be adopted.

The only known effective control is to be found by the use of adequate ventilation. This may be accomplished by means of a local exhaust system, attaching a metal tube to the exhaust pipe of the car and discharging the exhaust gases out-of-doors. General room ventilation created artificially by means of powered roof ventilators or general exhaust fans, strategically located for best results, may suffice. At most, ozone generators should not be used in lieu of adequate ventilation.

Joints for Wood Pipe

J. E. YORK

Building Service Engineer, Stone & Webster Engineering Corp.

Bored logs formed one of the earliest means for conveying fluids. Since then, there have been many improvements in the design of wood pipe. Methods of joining such pipe are illustrated and described.

AT Tse Liu Ching in China there are salt mines 2,000 years old which still use large bamboo pipe lines between the salt mills and refineries.

For a current comparison attention can be directed to a modern redwood continuous stave pipe for a hydroelectric development.

Wood pipe was used for water mains in both Greek and Roman cities and in the years 1609-1613, Sir Hugh Myddelton laid over 400 miles of wood mains in the City of London.

Since the first installation for Denver, Col., in 1884, redwood continuous stave pipe has been used throughout the United States and in many foreign countries for a wide variety of purposes including water supply systems for cities, towns and farms; irrigation systems; fire protection systems; drainage systems and hydroelectric lines.

For certain industrial operations requiring the conveying of chemical solutions or factory wastes it is almost indispensible.

There are four types of redwood pipe in common use at the present time as follows:

(1) Continuous stave pipe made of narrow staves that are milled accurately to true radial planes and to correct curvatures on the outside and inside faces. These staves are assembled in the form of a true circle and banded with individual steel rods. This type of pipe is furnished in inside diameters from 10 in. to 16 ft and for pressures up to 350 ft static head.

(2) Machine banded pipe made of staves milled as in (1) and assembled in sections. There are two varieties of machine banded pipe, one being wound with wire and the other with flat banding. Wire wound pipe is usually furnished in sections 4 to 20 ft in length and in inside diameters from 2 to 24 in. for pressures up to 400 ft static head. Machine banded pipe wound with flat banding is sometimes furnished in sections from 6 to 16 ft, although usually 12 ft is the maximum length. It is made in inside diameters from one or two inches up to 48 in. and for pressures up to 400 ft static head.

(3) Bored pipe is manufactured from straight grained stock in outside dimensions from 4 in. x 4 in. to 12 x 12 in. and in lengths up to 14 ft. It is bored through the center with inside diameters from 1½ to 6 in.

(4) Redwood lined metal pipe consists of flanged metal pipe lined with staves milled to fit the interior of the metal pipe. It is furnished in diameters from 4 in. to 30 in. and for the standard pressures of the metal pipe involved.

Joints for Continuous Wood Stave Pipe

The term continuous stave refers to the fact that the staves which form the body of the pipe are placed in a continuous unbroken line from one end of the pipe to the other, regardless of the length of pipe or stave.

To accomplish this it is necessary to provide some means of making a watertight joint at the stave ends, where they adjoin each other.

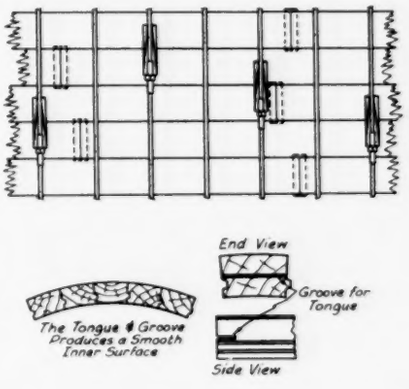


Fig. 1, upper. Typical wood stave joint. Fig. 2, lower. Section of staves showing tongue and groove connections for adjacent staves and slot for tongue.

This can best be accomplished by cutting a narrow slot in the end of each stave, in exactly the same position, into which a suitably sized piece of steel, called in wood pipe practice a tongue, may be fitted. During the process of erection of the pipe these tongues are placed in the slots and driven into the staves to produce a watertight joint.

The thickness of the slot is exactly the thickness of the tongue; the depth of the slot is slightly less than the width of the tongue; the length of the tongue is slightly in excess of the finished width of the stave measured along the slot.

In the finished pipe a strong watertight joint is made between the butt ends of the two staves and the sides of the adjacent staves. The staves are generally staggered in such manner that there is from 30 to 36 in. difference in the distance between ends of adjoining staves, thus bringing the joints at the stave ends opposite solid wood circumferentially considered, and 30 to 36 in. from the ends of adjoining staves.

Fig. 1, a section of a typical wood stave pipe, shows the location of stave ends and the circumferential penetration into the wood of adjoining staves to provide an effective water seal.

For wood stave pipe lines carrying corrosive chemical solutions, the tongues should be of copper, lead, oak or other material inert to the corrosive effects of

the liquid to be conveyed by and through the pipe line.

The staves vary in length from 8 to 20 ft, but the position of the butt joints in the pipe is controlled by using staves of the same length for each section of pipe after the initial section in which half of the required number of staves to form the pipe barrel are alternated with an equal number greater in length.

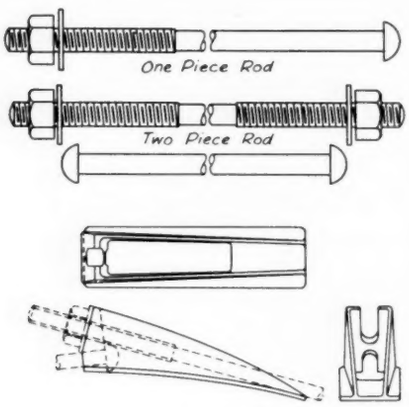


Fig. 3, upper. One and two-piece rods for continuous stave pipe. Fig. 4, lower. Shoes or lugs for such pipe.

As shown in Fig. 2, the joint between adjacent staves is made with a side tongue and groove of suitable size. The grooves in the ends of the staves for the metal tongues are also illustrated.

To hold the pipe together steel rods are used on all continuous stave pipes. These rods vary in standard practice from $\frac{3}{8}$ to 1 in. diameter depending on the pipe diameter and water pressure.

The tie rods and shoes, which are accessible for replacement without interruption to the flow of the liquid through the pipe, may be of steel. They can be readily replaced when necessary without disturbing the pipe line or interrupting the flow of water through the line.

Spacing of the rods on the pipe varies inversely with the internal water pressure. It is usual to design the rod spacing so that the working steel stress does not exceed 15,000 lb per sq in.

Tie rods are made in one piece or in two pieces, the former being used generally for pipes less than 54 in. diameter, and the two-piece rod for pipes of a diameter of 54 in. or greater.

The advantage of the two-piece rod for large pipes lies both in the comparative ease with which the rod may be placed in position and tightened, and the more uniform drawing together of the greater number of staves forming the barrel.

Where the one-piece rod is employed within the range of pipe diameter specified, it is manufactured with a button head on one end, the opposite end being provided with a cold rolled thread, Fig. 3, which gives at least the same strength through the thread as through the blank portion of the rod.

The two-piece rod for larger pipes, also shown in Fig. 3, is furnished with one of the pieces made with a button head on each end, and the other piece with cold rolled threads, nuts and washers on each end. The advantage of cold rolled threads lies in the fact that the rod may be designed for tensile strength based on the net area of the blank portion.

Rods are normally furnished with a protective coating of asphaltum that is formulated to prevent spalling or chipping in cold weather, or flowing in hot weather. Where corrosive conditions are severe, rods may be furnished galvanized or of alloy resistant to the conditions encountered.

The shoes, or lugs, that connect the ends of the pipe and permit its tightening are made of malleable iron of such design that the rod has a straight pull throughout its length. This eliminates distortion and the possibility of secondary stresses.

The design of the shoe, Fig. 4, is such that it is proportioned to develop the full elastic limit of the rod before distortion occurs in the shoe itself, and thus the strength of the rod becomes the criterion of design. The shoes vary in size, length and bottom curvature to fit both rod and pipe and they are furnished with standard asphaltum coatings except where specified galvanized.

The one-piece rod requires one and the two-piece rod, two malleable iron shoes respectively. The position of the shoes is shown in Fig. 1.

Connections to Steel Pipe

Depending upon the pressure involved, there are several methods of making connections between continuous stave pipe and other pipe.

In connecting to a steel pipe where moderate pressures are involved, the simplest method is to provide a steel sleeve as part of the steel pipe, smooth on the outside, either welded or riveted to the pipe with rivets countersunk, and having an outside diameter corresponding to the inside diameter of the wood pipe.

The ends of the staves of the wood pipe are allowed to lap over the steel sleeve for approximately 3 ft and are tightly cinched down on a layer of canvas or burlap heavily impregnated with white or red lead pigment.

This type of joint is particularly suited to above ground connections, but it is subject to criticism on the ground that it does not permit proper saturation of the wood pipe where it overlaps the metal, thus leaving it subject to decay. It is considered better practice to insert the wood pipe into the metal pipe and caulk with lead and oakum. To prevent distortion of the wood pipe when caulking, a heavy iron ring must be provided inside the end of the pipe. This ring should be of plain hoop iron varying from $1\frac{1}{2}$ in. in width by $\frac{1}{2}$ in. thick for 24 in. pipe, up to 4 in. in width by $\frac{5}{8}$ in. thick for 7 ft diameter pipe. Internal hoops of angle iron should not be used as they constrict the area of the pipe.

Two other methods are suitable for making connections to steel pipe and are generally used where

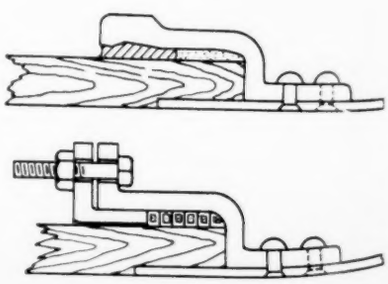


Fig. 5, upper. Joint between wood and steel pipe, low and medium pressures. Fig. 6, lower. Joint between wood and steel pipe subjected to high pressure.

higher pressures are involved. In the first of these methods, Fig. 5, a cast iron or cast steel hub is riveted to the steel pipe. The inside diameter of the cast hub should be sufficient to provide not less than ½ in. caulking space all around the wood pipe. The joint should be packed with oakum, and a lead joint poured and caulked in the conventional manner.

If the steel pipe cannot be extended forward to support the ends of the wood pipe as shown, a steel ring should be inserted in the ends of the staves. This steel ring should be ⅜ in. thick by 2 in. wide and its purpose is to prevent the ends of the staves springing in under the caulking blows. After packing with oakum, pour a lead joint and caulk tight.

Where high pressures are encountered or where, as in the case of a conduit to a large hydroelectric plant, there is a necessity for continuity of operation, a joint must be made that cannot blow out.

In such case a cast steel hub machined smooth on the inside is used with a fiber packing held in place by a gland ring bolted to the main casting as shown in Fig. 6.

The steel pipe must project forward to support the stave ends as shown or a steel ring inserted as described for the joint illustrated in Fig. 5.

Connections to Masonry

When making a connection to a concrete box or forebay structure located above ground, it is advisable to set a steel sleeve into the concrete and lap the staves over the outside of the steel sleeve on a layer of canvas or burlap heavily impregnated with white or red lead pigment as described for connection to steel pipe.

A more durable type of connection, Fig. 7, may be provided. With this type of joint the staves can be built directly into an opening provided in a concrete wall. The opening in the wall should be at least 2 in. greater than the outside diameter of the wood pipe

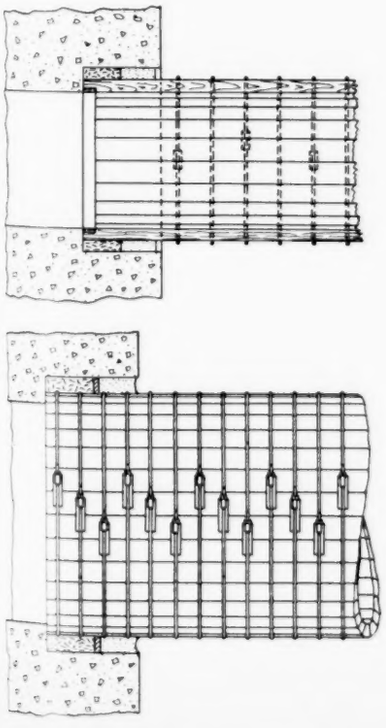


Fig. 7, upper, and Fig. 8, lower. Two methods for making joints between continuous stave wood pipe and a forebay structure.

to provide space for caulking. The caulking recess should be at least 12 in. deep, although for pipe less than 4 ft in diameter, it may be reduced to 8 in.

A circular ring, as indicated, is inset into the stave ends. The recess should be caulked for a depth of approximately 4 in. with oakum impregnated with a fluid cement grout and driven as hard as possible, after

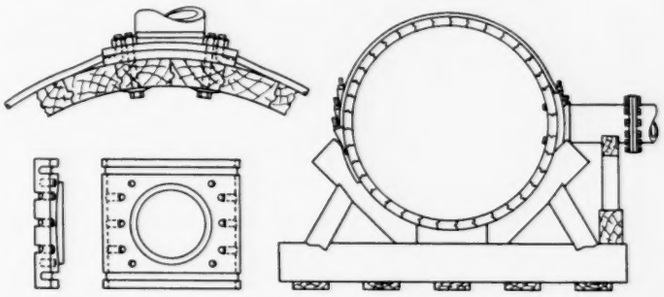


Fig. 9, left. Connections between wood stave pipe and branch piping, air valves or blow-offs. Fig. 10, right. Connection for manhole or heavy branch connection showing support integral with pipe support.

which a neat cement packing should be used for the remainder of the opening. This cement packing must be mixed very dry, the object of which is to have present a mass of particles of dry cement available for expansion as water ultimately penetrates the packing. It is advisable to finish the joint approximately one inch back of the face of the concrete wall to permit further caulking with lead wool should it be required.

This type of joint will usually prove tight and satisfactory for a long period, but if the pipe should remain empty for any considerable length of time under conditions which will permit the staves to dry out, some leakage, though probably slight, may develop at the joint and obviously will be difficult to correct unless the inside face of the structure can be reached for caulking.

An alternate method of making a connection to a concrete structure is shown in Fig. 8. A circular opening should be provided in the concrete wall with a diameter from 6 to 8 in. greater than the outside diameter of the wood pipe. The depth of the opening in the wall should be approximately 18 to 24 in. The section of wood pipe is set up complete with bands and shoes in place. After fully tightening the pipe rods the end of this section is placed within the wall opening and, after packing in the usual manner with oakum, is grouted into place.

Pipe Outlets

Openings for branch piping, air valves, blow-offs or manholes are most economically provided by the installation of saddles of cast iron or cast steel made to fit the outside curvature of the pipe and held in place by steel rods which pass entirely around the pipe. These rods engage the saddle casting on each side as shown in Fig. 9.

The rods which encircle the pipe are fixed to the saddle casting in such a manner that they draw the casting down on the sheet gasket placed between the casting and the staves. To further insure this contact,

bolts are passed directly through the casting and the staves.

Manhole castings or saddles of large diameter may be of considerable weight and they should preferably be attached to the side of the pipe where their weight may be supported independently of the pipe itself, as

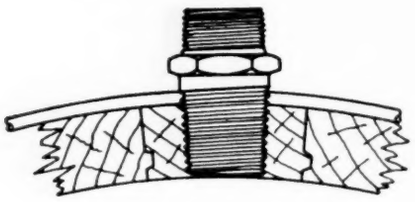


Fig. 11. Connections to wood pipe for a small outlet.

shown in Fig. 10. It should be remembered that provision must be made for tying together both pipe support and saddle support to prevent unequal settlement.

Small outlets where the pressures are not in excess of 100 ft head may be provided by using a brass nipple with a wood thread screwed directly into the circular opening in the pipe stave. The diameter of the hole bored in the pipe stave should be slightly less than the diameter of the nipple at the root of the wood thread. This type of joint is shown in Fig. 11.

Joints for Machine Banded Wood Pipe

Wire wound machine banded pipe is normally furnished with wire wound collars for forming the connections between sections. Sometimes on larger diameters of pipe, collars are equipped with individual bands and shoes instead of being wire wound. In forming connections a tenon is turned on each end of the section. The collar is made of a diameter to conform accurately to the tenon in a driving fit.

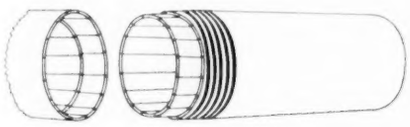


Fig. 12. Section of wire wound wood pipe with collar.

Machine banded pipe made with flat banding is furnished with a tenon turned on one end and a mortise turned on the other end of the section to produce an accurate driving fit.

No special equipment is needed for installation purposes. A driving block is inserted in the end of the pipe and the sections are simply driven together. Small diameter pipes can be driven together by a wood maul. For larger diameter pipes a driving ram is generally used, which is suspended from a cross bar or a frame straddling the trench. A section of wire wound pipe with a collar is shown in Fig. 12.

Joints for Bored Wood Pipe

The joint between adjacent sections of bored wood pipe is made by forming a turned tapered spigot on one end and a corresponding socket on the opposite end, the sections being simply driven together during installation as shown in Fig. 13. Angle connections are formed by cutting in similar pieces of material in the manner indicated. No metal is used with the pipe excepting a light gage galvanized or copper ferrule which is sometimes placed on the socket end to avoid splitting the piece when assembling in place.

Joints for Wood Lined Metal Pipe

Connection for wood lined metal pipe, Fig. 14, is made in the usual manner for plain metal pipe. When field fitting is required the pipe is sawed off to the required length and a flange welded in place.

Joints for Fiber Pipe

Conduit made of virgin wood fiber and impregnated with coal tar pitch by a vacuum and pressure process has been used by the electrical industry for underground services for more than a quarter of a century.

Sewer pipe of the same material offers the following advantages:

(1) Flexibility which prevents rupture by uneven settlement of the sub-base.

(2) Mechanical strength and toughness to prevent shattering from traffic shock.

(3) Permanence—as the wood fiber is protected by inert coal tar pitch with which it is combined to form the pipe.

(4) Light weight—about one-third as much as clay pipe and one-sixth as much as cast iron pipe.

(5) Simplicity and tightness of joints and a lesser number of joints due to the use of 8 ft long sections of pipe. This type of pipe is made in the following sizes: 3 in., 4 in., 5 in., and 6 in. diameter. Joints are normally made by means of a tapered end of the pipe which fits into a coupling as shown in Fig. 15.

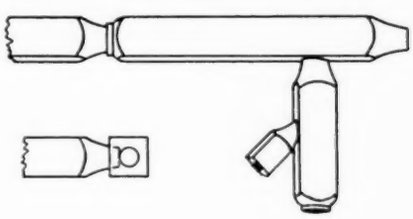


Fig. 13. Joints for bored wood pipe. Use of pipe is limited to a static head of 50 ft. maximum.

The procedure for making a joint is as follows:

(1) Lay the first length of pipe.

(2) Place the coupling provided with each length of pipe loosely on the end of the first length of pipe.

(3) Insert the second length of pipe in the coupling on the first length of pipe.

(4) Place coupling on the farther end of the second length of pipe.

(5) Hold hardwood block firmly against last coupling and drive both couplings up together with two or three smart blows of a light sledge or heavy hammer. The long smooth taper makes a

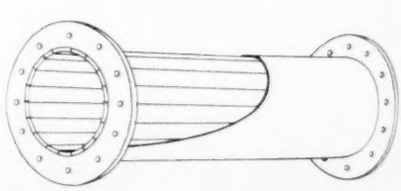


Fig. 14. Wood lined metal pipe.

Fig. 15. Tapered end of fiber pipe and coupling, and method of assembling joint.

watertight joint without compounds. Never hammer directly on the taper joint.

For connecting adjacent sections of fiber pipe of differing diameters, the reducer shown in Fig. 16 may be used.

For changes in direction a sufficient number of joints using 5° angle counplings should be used.

Where it is necessary to make a joint between two unfinished ends of fiber pipe or between an unfinished end of fiber pipe and the spigot end of a piece of cast iron pipe, the joining sleeve in Fig. 17 should be used. The ends of each section of pipe should be taped, the space between the pipe ends packed with oakum and the remaining space inside the sleeve sealed with cement.

An adapter for making a joint between fiber pipe and the hub end of a section of soil pipe is shown in Fig. 18. The joint between the fiber pipe and the adapter is made with a standard fiber coupling. The straight spigot end of the adapter is inserted into the bell end of the cast iron pipe and the joint is packed with oakum and sealed with cement in the usual manner.

A joint between fiber pipe and the bell end of a section of clay pipe is made without the use of an adapter as the end of the fiber pipe may be inserted in the bell end of the clay pipe and after packing with oakum

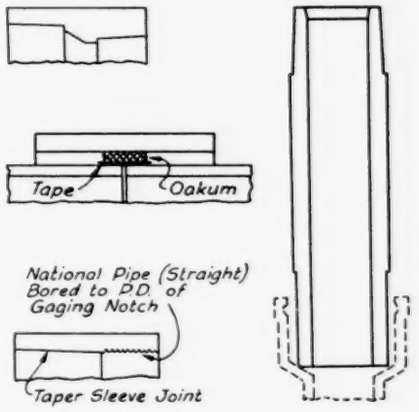


Fig. 16, top. Reducer for fiber pipe. Fig. 17, center. Joint for two ends of fiber pipe. Fig. 18, right. Adapter between fiber and soil pipe. Fig. 19, bottom. Joint connecting fiber pipe and threaded iron pipe.

any of the compounds commonly used for joining clay pipe may be used.

Joints between fiber pipe and threaded iron pipe can be made by the employment of the adapter shown in Fig. 19.

For further information on joints for wood pipe and fiber pipe, the reader should refer to bulletins published by the following:

The California Redwood Association, 405 Montgomery St., San Francisco, Calif.

Bermco Sewer Pipe and Perforated Pipe by the Brown Co., 500 Fifth Ave., New York 18, N. Y.

What Causes Water and Gases to Spiral?

An architect came into the office the other day and made an offhand remark which started such a lively discussion that he finally left without thinking of the business in hand. It seems that he preferred rectangular shapes for down spouts from rain water gutters. Water spiralled in down spouts of circular shape, so he said, hence carried off less water as the water had to travel a further distance when going in circles.

It was Venturi in 1798 who first described the phenomena of the whirl of water at the outlet of a vessel. He stated that the whirl is greatest near the vertical axis through the center of the orifice, and as the head decreases, a funnel is formed through the middle of the issuing stream. The direction of this whirl, as seen from above, may be either clockwise or counter clockwise, depending on initial motion in the water or on irregularities in the vessel or orifice, but under ideal conditions it should be clockwise in the southern hemisphere and counter clockwise in the northern hemisphere, this being the effect of the earth's rotation. If a large piece of cardboard is floated on the water surface above the orifice, the whirl disappears, as it does also at the Equator.

When water is turned on at the faucet in a lavatory it comes out in a spiral motion. If it is the left hand faucet the impact of its stream gives the water in the lavatory a motion to the right in the only direction left for it to go. Opening the right hand faucet produces an opposite motion, but if the faucets are closed and the water is quieted, close watching will show the direction of whirl is as Venturi discovered, even as it will be observed in the smoke leaving a chimney in still air. So the architect was wrong, for the spiral will be there in a leader pipe running full, regardless of its shape. The theoretical time for discharge is greater due to a spiral, but it cannot be timed on a watch.

Pursuing this matter of spirals a bit further, an oil burner in one installation produced a lot of noise in the smoke pipe until someone inserted a spiral curve of sheet metal within the pipe. Possibly, the gas flow through the pipe had exceeded the critical velocity and had gone into the region of turbulent flow. The writer does not know the real answer, however, because it would seem that the spiral would but serve to increase the critical velocity and therefore set up turbulence within the spiral.—*T. W. Reynolds.*

THE SALES ENGINEER

Is Entertainment of Customers Sound Business Practice?

BERNARD LESTER
Sales Engineering Consultant

THE correct answer to this question is "yes"—but it most certainly requires defining what we mean by entertainment.

Selling heating and ventilating equipment, like other types of apparatus, involves the human element of fellowship. Not one of us would desire or attempt to separate business dealings from friendship. When perhaps half our waking hours are spent in contact with business people, who would want to bar any constructive influence that contributes to mutual acquaintanship and understanding? Some forms of entertainment provide this. Others ultimately destroy it. Fortunately, there has generally been a steady improvement in the form and limitation of customer entertainment. Yet, there are still those who attempt to "buy" business through reckless and unprincipled spending.

Every supplier, no matter whether he sells apparatus or sells a service, should face the problem frankly and fairly. He should evaluate the extent, character and value of entertainment done, to see that in the long run it helps build sound acceptance for his products and services, and does not ultimately destroy his business structure like termites in wood framework.

Form of Entertainment

The form of entertainment used indicates both the character of the sales engineer and the company he represents. If it is niggardly, drab, meaningless or vulgar, he and his company take on these characteristics in the customer's mind. Such entertainment tears down rather than creates.

Lavish entertainment pointed only toward obtaining an important order, insults the intelligence of worthwhile customers. Is there any thinking purchaser who does not know that he ultimately pays the bill? But when a contract is obtained, and its completion requires team work from a group of persons involved, is it not desirable for the seller's men and buyer's men to get together, get well acquainted and form a progressive team? Some sort of diversion may definitely contribute to understanding and cooperation.

Many a sales engineer argues that extended entertainment is necessary in his particular work because the use of his company's pocketbook may be easier for him than use of his mind and legs Another argues in favor of it, because he himself enjoys lavish entertainment. He basks in the personal approbation he gets. He is often blind to the fact that friends disappear when he fails to pick up the check and pay it.

Suggested Rules

Each sales manager and sales engineer must establish his own rules for entertainment,—each his own standards to live by. The following are strictly my own rules regarding proper entertainment. Perhaps they may "click" with some readers.

(A) If entertainment of the customer definitely contributes to fellowship and provides opportunity for an exchange of ideas, it is justified.

(B) All entertainment should be in keeping with the occasion and be of a high character.

(C) All entertainment should possess quality without lavishness. It is best to entertain less often and well, than poorly and frequently. Select a good eating place, golf club or show.

(D) Cut out excess or vulgarity. Remember the headaches and guilty disgust that may later disrupt friendships.

(E) Presents at Christmas or similar occasions have have no place unless moderately priced, and unless they have personal significance. Large gifts are plain graft. They should be "out."

(F) It is a bad practice to pay customer's expenses for extended trips or "junkets." These constitute bribery, and must ultimately swell the customer's bill.

Entertainment in transacting business has definitely contributed to personal understanding. It has enabled buyer and seller to break through that hard surface which formerly characterized many business dealings. It has been one means of creating good will. It has enabled us to know one another better and, consequently, trust one another.

However, entertainment is only a tool, and if misused the damage is both serious and lasting. A careful watch of entertainment expense is not the answer. What counts for most is the character in which we entertain our friends.

Experience is my Classroom

By T. W. REYNOLDS

ECONOMICS OF HEATING

In the old days, various boiler salesmen would harangue the school board about a boiler to be purchased for the school. The building just would not heat if their boiler was not used, so they said, or words to that effect. The Board listened patiently, then one old fellow arose and said: "If one half the things these fellows say about their competitors' boiler are true, then we are better off without any boiler. I move we keep to the present old pipeless furnace."

RADIATOR PARADE

Many radiators and pipe coils came and went—the early form of sheet metal radiators, the return bend pipe coil with its great friction due to pipe in series and the numerous bends, the box pipe coil, which was a series of return bend coils grouped together, causing a loss of efficiency due to close grouping, the Gold Car Heating Co. pin and other forms of extended surface radiators, and the direct-indirect radiator.

There were window radiators and there still are such units. Some radiators were curved to fit the old bay window, others were low at the window with higher columns each side, some fitted the right angles of a corner, others were arranged in a series of steps to go along a stairway and then there were the flue type radiator and the pantry radiator.

There were many arguments regarding the proper position of the air valve and the final abandonment of the steam type radiator in favor of the hot water type for both steam and hot water. Contractors, in particular, said this could not be done, but it was done.

Most radiators, either wall or column, were very ornate and much in evidence. Though no one would have one today, Alfred G. King (in his 3rd Edition, Revised, 1919, of "Practical Steam and Hot Water Heating and Ventilation") said: "From the old pipe box coil, or the pan radiator made of sheet iron, to the American Radiator Company's 'Verona,' or, in fact, almost any one of the present ornamental cast iron radiators, is an achievement of which any person connected with the heating industry may be justly proud."

Note: Mr. Reynolds is Chief, Air Conditioning Division, Abbott, Merkt & Co., Engineers, New York.

FILTERED AIR DUSTIER THAN NO AIR

If one wants to keep dust out of a space in which there are no exhaust ventilators and no particular problem of heat removal, which is the better method—to supply filtered air to this space from a fan so that the space will be under a slight pressure, or to just leave the room alone to itself with but normal convection currents of socalled still air? Would not the great quantity of air required to keep the space under pressure even though filtered, bring in more dust than the otherwise very slight in-leakage of unfiltered air?

This is a question that arose due to a recommendation of the fire underwriters in a certain case. In this case, in line with modern practice to centralize the large starters and cubicles for a fire pump and four interconnected service pumps, the electrical equipment will all be located in a separate room adjoining the pumps. There they will be serviced at a central point and will be safe from interference, possible water damage, mechanical injury and dust.

The expense for the separate room, the additional wiring required and the fan with filter are considerable. Another objection is that any room under pressure has no appreciable air movement and so becomes but a settling chamber for dust. The proposed arrangement does violate the long standing rule of locating starters within view of the apparatus they control, though it is true that cutout switches can be located at the pumps, so that anyone working on them can prevent their operation.

In the event that such a room is constructed, it should be made reasonably tight, so that pressure will be raised therein with a smaller quantity of air blown in. It is true that all of the supply air that enters the room must leave it and therefore exclude entering dust at these points of exit, but such cracks as are not exits may still allow some dust to enter through them.

THE FLAT SPECIFICATION

Salesmen like to tell you, if they know you well enough, that you have not got the courage of your convictions to specify things flat. They do not like the words "or approved equal," and neither does the writer. He likes to specify a product flat when it is as good as the best.

Both the owner and engineer get good service and the owner often saves money where the engineer is a steady customer of the manufacturer. The salesman does not have to go around selling everyone from owner to contractor to engineer. Quite often where the owner or engineer has made an error or changed his mind on the layout, the manufacturer will take back what is on the job and ship what is wanted finally without any charge. The writer could cite many such cases.

The objection of many an engineer to the flat specification is one of the price being raised where there is no competition. The writer, having spent part of his career with a manufacturer, believes this reasoning to be largely theoretical. It is true that in many cases a slightly higher cost is entailed because of the flat specification. But let us put it another way. Let us say the manufacturer does not have to take practically all the profit out of the sale. He gets a reasonable price, a fair return, and can serve you better because of this.

There will be less trouble with product where the price is paid. Since materials have been scarce, the flat specification has prevailed without trouble. In fact, one was happy to get material from any source. Scarcity sometimes compels one to take equipment supposedly much inferior, only to find that such equipment isn't so bad after all.

Now there is one reason for avoiding a flat specification that never seems to be mentioned, at least the writer has found this so. A number of contractors have complained about the lack of courtesy or of information from manufacturers as to servicing the job. The engineer who wrote the flat specification will receive the necessary attention, but the contractor, who has to put the equipment in, will not even receive a copy of the correspondence to the engineer, so as to know what is going on. Since the contractor may at some time or other be a voluntary buyer of the manufacturer's product, it would seem that the manufacturer's neglect of the contractor is only due to the times and the scarcity of labor. Service is kept to a minimum and has been none too good, even for the writer.

TOO MUCH FANFARE

As an engineer with a manufacturer of heating equipment in the long, long ago, the writer detested being lugged around by some contact man and introduced to a customer's engineer with "Now, here's an expert on the matter," or "This is our chief engineer." To this one engineer replied, "So what."

It was evident that the prestige of the customer's engineer was in question with such a form of introduction. One could see him looking over the manufacturer's engineer with the thought, "Does this funny looking bozo with his noisy press agent think he is coming in here to tell me something?" Certainly, the manufacturer's engineer was launched to a bad start.

Now there is a time to talk engineering and a time to refrain. In other words, it is sometimes good engineering not to talk engineering. This was one of those times, so the writer, left to his own resources by the press agent's hasty retreat, talked of anything but engineering. The other engineer listened knowing he must be of some moment, or he would not be on the payroll of a large manufacturer. From listening he fell to talking, and being an engineer he could not talk long without talking engineering. Soon we got to exchanging ideas on engineering matters and it finally ended with his being somebody talking to somebody.

NEW RULES DOUBLE THE OIL STORAGE CAPACITY

At long last, or since July 12 of this year, one can legally have two 275 gallon tanks inside a building in New York City. This enables dealers to fill up consumers tanks in the summer months and then store in their own tanks an equivalent amount, practically doubling the local oil storage capacity and lessening pressure on the dealers, railroads and all concerned during the heating season.

The lesson seems to be that what was once considered too dangerous a practice is no longer so considered, apparently merely because the need or pressure is so great. In any event, the seasonal nature of the oil business will be less noticeable, but no doubt the consumer will pay no less for his oil than before. Meanwhile, adding a second tank (as many now will do) to the existing tank has already introduced some complications in the way of interconnecting them, which in turn had led to many contentions, conjectures, magnifications of troubles, and proposed remedies of various kinds.

Any liberalization of the oil burner rules has led to further proposed changes. For example, steel is hard to get and those who sell aluminum would like to sell more of it. Oil tanks of aluminum would furnish a new market for that metal, considering the great demand for an additional tank in existing installations. Why not, such tanks are light and nice appearing in exposed places. They, no doubt would stand the heat, though the melting point of aluminum is less than half that of steel.

At first, and even yet, until the matter of proper connections is legally settled (which may be done by the time of going to press), the tanks are twinned together with piping in such a way that neither tank is favored (Fig. 1). Bull head tees are always bad, however, in any piping work and somehow the oil goes first to one tank and meets, at the junction of the two vents, the air escaping from the other tank.

Oil is then ejected from the vent, so it is said, but the writer believes that this will not occur providing both valves on oil delivery lines from the tanks to the burner are left open at the time of fill, or the tanks are not quickly filled when empty (except for a lot of air to vent), and finally provided that the two vents are connected as in Fig. 2, so that one is 2 ft higher than the other. Another thought in continued rebuttal is that the Fire Department is not particularly excited about a small amount of oil that might be vented to some one's lawn, as long as the vent is kept out 2 ft from any building opening as required by rule. This is why the vent is kept out from the building and not, as some suppose, to prevent odors from entering the building. The Fire Department is not the Board of Health.

In saying all these things, however, one must recognize that the 2 ft headroom is not always available and also that the law says only one valve can be opened at a time; that is, the valve on the tank in use. This rule is in contemplation of the greater quantity of oil which could be released in the case of a break in the joint oil burner feed.

Fig. 3 shows the proposed legal method of connecting the tanks. The oil (2 in.) goes first to the new tank and then by connection (2 in.) across their tops to the existing tank, which being old or older than the other, is supposed to be weaker, but under less pressure, measurable or otherwise, due to its being vented direct to atmosphere. The vent pipe must be 1¼ in., so that perhaps one urgent reason for the proposed piping procedure is that existing tanks have 2 in. fill openings and 1 in. vent openings.

GETTING THINGS DONE

For many years the writer was brought up under bosses. One of these, a consulting engineer, when he got a new job, would sometimes rough out the ducts in an evening at home where there was no telephone, boss, or other interruption. In the morning his midnight effort would be shown about the office with, "See what I did in a few hours. Why can't you fellows knock out the plans in the same time?"

You don't argue with bosses, at least it was not the custom in those days. You did realize, if only in a hazy sort of way, that they had to make a profit and also get the job out by the time stipulated. So we did not say "Yes," and did not say "No." We just got busy and worked for the next few weeks getting the bugs out of his overnight dream.

They say that the eyesight dims as the years mull along, but the writer, looking backward, can now see things he did not see before. Thus, the boss did not intend to present a finished layout to us nor a layout without some errors. He just wanted to get going and to do so with a good running start, for one has to start in order to get a clear idea of what the problem really is. Presenting something that we finally know we do not want, once we see it on paper, starts something we do want.

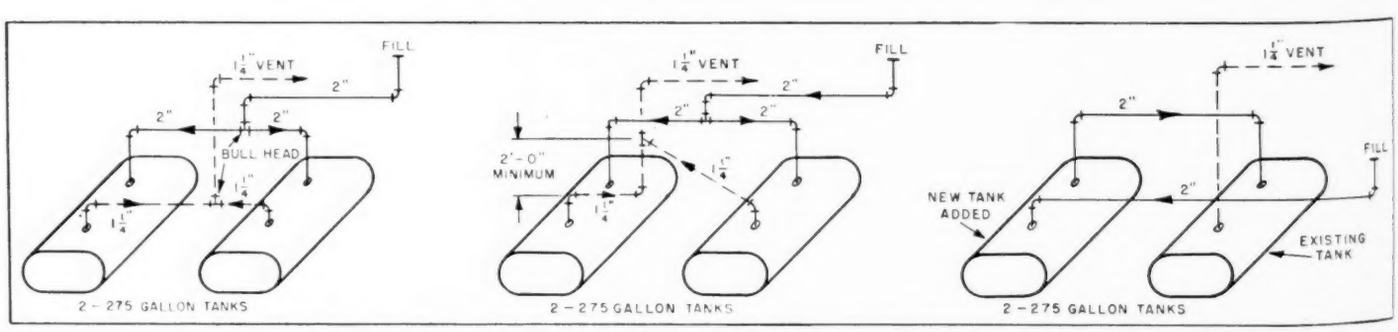


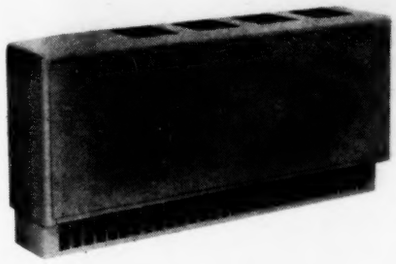
Fig. 1. (Left) Present method of twinning oil tanks. Fig. 2. (Center) A good method of eliminating oil discharge from vent. Fig. 3. (Right) Proposed method of twinning oil tanks.

NEWS OF EQUIPMENT AND MATERIALS

Webster-Nesbitt Unit Heater

NAME—Webster-Nesbitt Series R unit heater.

PURPOSE—For quiet offices, church, lobbies, high grade restaurants and similar applications where low noise levels are essential. When adjusted



to a higher speed the unit can be used in any commercial or industrial application.

FEATURES—A deluxe, cabinet type, floor-mounted unit heater of the unit ventilator type, the successor to the company's pre-war Series F unit heater. Heating element is non-ferrous, of copper tubing and aluminum fins. Element is of the hairpin circuit type, with supply and return headers on one end, and return bends at the opposite end. Suitable for steam or forced hot water circulating systems. Where desired, the unit can be equipped with an air filter, located beneath the heating element, to filter air entering the element. Fans are forward-curved type, designed for operation at low tip speed. Fans are supported from rubber-mounted, graphite packed sleeve bearings. The standard motor is resilient-mounted, constant speed type operating at 1725 rpm. V-belt drive with variable pitch motor sheave permits 30% change in fan speed. Cabinet of furniture steel is furnished in lizard brown featherweave or neutral gray prime, with attractively designed louver type inlet and discharge grilles. Removable front allows easy access to the interior. Units may be arranged for vertical, horizontal, wall or inverted mounting. An end compartment provides space for motor, supply and return piping, and electrical connections.

SIZES AND CAPACITIES — Available in four sizes with one, two, three, four or five fans and with capacities ranging from 38,000 to 141,000 Btu per hr at 2 lb steam pressure and 60F entering air temperature.

LITERATURE AVAILABLE — 12-page bulletin WN-133 which includes information on selection of correct size unit and technical data on design and installation.

MANUFACTURER—*John J. Nesbitt, Inc., Philadelphia 36, Pa.*

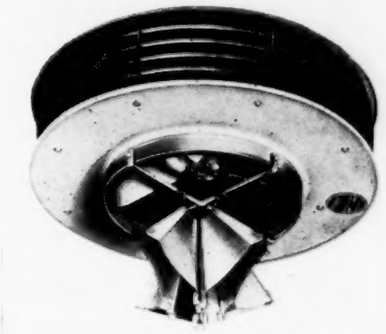
DISTRIBUTOR — *Warren Webster & Co., Camden, N. J.* 333

Air Diffuser

NAME—Cloverleaf diffuser.

PURPOSE—Air diffuser to direct air movement in patterns ranging from straight down to almost straight out.

FEATURES—Designed for use with Trane projection unit heaters, it can be so arranged that some of



the air stream is directed downward while another portion can be projected almost horizontally. At any angle of spread beyond the completely collapsed position, it develops an induced air effect. Unit is constructed of individual blades hinged together in a cone-like form. The blades are die formed from 18-gage steel and the center of each blade forms a smooth concave surface or valley. A short space adjacent to the hinged edges is flat to provide adjustability from a full open to completely closed position. Spring steel slip rings suspend the hinged blades from tubular support rods securely fastened to the fan orifice ring. Adjusting bolts are spaced evenly around the edge of the cone at alternate blade junctions. When the bolts are loosened the diffuser may be opened and closed like an umbrella. Once the proper position has been obtained, the bolts may be tightened to hold such a setting. Segments of the diffuser receive the full force of the spiral action of air leaving the fan. As air from the fan strikes the segment the air stream is divided up. Coming off the diffuser, the air stream breaks up into nearly separate streams to form a cloverleaf pattern on the floor.

MADE BY — *The Trane Company, LaCrosse, Wis.* 334

Smoke Tester

NAME—True-Spot smoke tester.

PURPOSE—A hand-operated instrument for checking clean firing in oil burners.

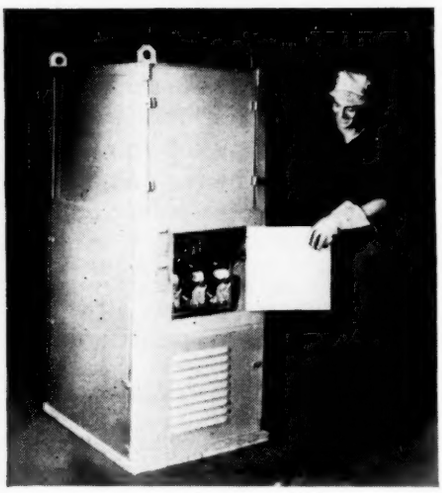
FEATURES—Instrument is operated by locking a paper test disc in place, inserting the metal probe into a suitable hole in the smoke pipe, and then drawing in a combustion gas sample from the flue with six pump strokes. Drawing the sample through the tester will turn the test disc to a shade of gray depending upon the smokiness of the flame. The disc is removed from the instrument and, by comparing the color with a standard color chart, smoke density can be determined. Handle of instrument is designed to hold a supply of test discs.

MADE BY — *Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh 8, Pa.* 335

Air Conditioner

NAME—Dravo air conditioner for crane cabs.

PURPOSE—To protect crane operators from the hazards of excessive heat and noxious gases in factories.



FEATURES — Unit was designed to operate in ambient temperatures up to 130F and under such conditions to maintain cab temperatures at 80 to 85F in the summer and 68 to 72F in the winter. It can be mounted alongside a crane cab or placed on adjoining catwalks. Air is used for condensing purposes in the cooling coils and the refrigerant is Freon - 114. About 300 cfm of return air is blended with 100 cfm of makeup air and introduced into the cooler. Filters remove dirt and dust from both return and makeup air. Activated carbon cannisters in the air stream are used to take out fumes and irritants. Electric strip heaters are chrome steel sheathed with monel metal fins, available for winter heating. A 3-hp compressor motor is supplied with positive forced ventilation by cool air from which dust and fumes have been removed. The ventilating air fan motor is in the path of the cooled air. Supply and return air openings placed on the top of the cooler are said to minimize the amount of insulated duct work required.

SIZES AND CAPACITIES—Unit measures 5 ft. 5¾ in. high, by 2 ft 2 in., by 2 ft 9 in.

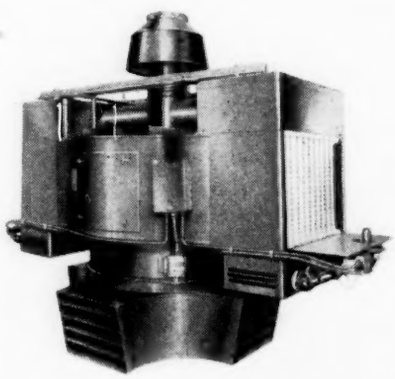
MADE BY—*Dravo Corporation, 5th and Liberty Ave., Pittsburgh 22, Pa.* **336**

Unit Heater

NAME — Wing gas-fired revolving unit heater.

PURPOSE—Space heating.

FEATURES — Unit is designed for overhead location and to project the heated air to the working level by means of revolving outlets. Unit uses a Wing foil fan and Wing revolving discharge outlets. Heat exchanger and combustion chamber of gray cast iron are cast in one piece. No gaskets are required. Extended heating surface fins on the heat exchanger are cast integral. Gas burners are constructed of gray iron with drilled ports. Each tube of the heat exchanger has a separate burner head which permits flame to burn in the tubes without impingement on the metal. In summer, unit can become a cooling device by turning off the gas and operating the fan.



LITERATURE AVAILABLE — Bulletin.

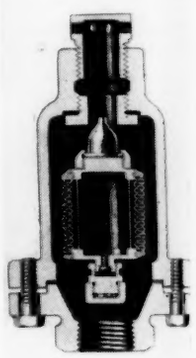
MADE BY—*L. J. Wing Manufacturing Co., 158 West 14th St., New York 11, N. Y.* **337**

Air Vent

NAME — Sarco high pressure air vent.

PURPOSE—For release of air from industrial steam systems.

FEATURES—Vents operate on the principle of the Sarco thermostatic steam trap. A flexible bellows of heavy wall phosphor bronze tubing is partially filled with volatile fluid. When bellows is heated by the steam that surrounds it, the fluid boils and builds up a vapor pressure inside the bellows which is slightly higher than the steam pressure on the outside so that the bellows expand, closing the discharge valve and preventing steam from escaping. Bellows contracts again as soon as the body cools below the steam temperature thereby opening a discharge valve. For pressures of zero to 100 lb per sq in., body and bonnet are of cast brass while the bellows are phosphor bronze. The renewable valve head and seat are of stainless steel. The vent for pressures of zero to 200 lb per sq in. has body and bonnet of semi-steel with renewable valve head and seat of stainless steel.



SIZES AND CAPACITIES—Series V-100 for pressures to 100 lb per sq in.; series V-200 for pressures to 200 lb per sq in. Also made in pipe sizes from ⅜ to 1½ in.

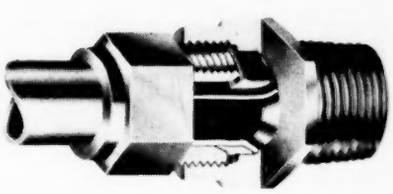
LITERATURE AVAILABLE — Bulletin No. 275.

MADE BY—*Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.* **338**

Tube Fitting

NAME—Uniflare fitting.

PURPOSE—Self-flaring tube fitting for use with copper, aluminum, monel and annealed steel tubing.



FEATURES—Fitting has a body and a nut. Thrust collar in the nut shears off under ordinary wrench force and clamps onto the tube to form a sealed joint. Use of fitting is said to eliminate preliminary flaring and the possibility of tube cracking.

MADE BY—*Scovill Mfg. Co., Waterbury, Conn.* **339**

Air Conditioning

NAME—Frigidaire packaged air conditioner.

PURPOSE—Air cooling for occupancies that can be served by a 10-ton capacity unit.

FEATURES—Cooling unit employs the Frigidaire Multipath principle of refrigerant distribution in order to assure, it is claimed, even temperatures and uniform humidity conditions, regardless of outside weather conditions. A thermostatic expansion valve permits the flow of refrigerant to the cooling unit. A 10-hp water-cooled reciprocating-type compressor supplies refrigeration to one of two models; a 10-hp evaporative type unit is provided to operate with a Frigidaire evaporative type condenser. Twin condensers of the water-cooled finned type are mounted on the structural steel base. Series-type flow condenser heads and an automatic water valve are supplied for city water applications. Centrifugal blower fans with 12-in. blades circulate air to conditioned areas. Fan compartment and cooling unit are insulated with sound-absorbing and heat-retarding material. Acoustical insulation on the inside top of the machine compartment reduces compressor noise.

SIZES AND CAPACITIES—Two models similar in design except that one model has been designed for use with a Frigidaire evaporative-type condenser where the water supply or drainage is limited or where water must be conserved.

MADE BY—*Frigidaire Div., General Motors Corporation, Dayton 1, Ohio.* **340**

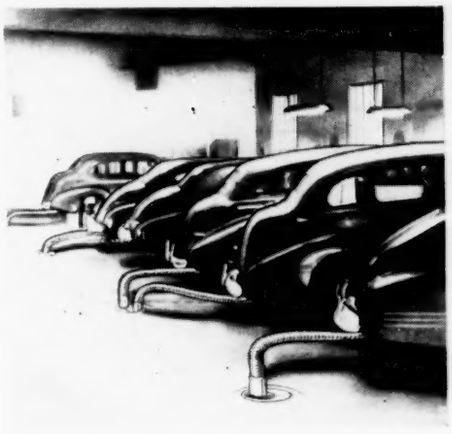
Garage Ventilation

NAME—National system of garage ventilation.

PURPOSE—Removal of carbon monoxide and other gases from confined spaces in garages.

FEATURES — System is completely fabricated at the factory and is shipped ready for installation. The packaged kit includes motor and discharge chamber blower, designed for specific needs, and two double dial-o-vent floor assemblies, each capable of serving two cars at the same time. Four flexible metal tubes are used to carry exhaust gas from the tailpipe to the floor vent. Complete fabricated duct work carries the exhaust gas to a point outside of the building.

OPERATION—In installing this system it is necessary to dig a trench, place the assembled system in the trench, and then fill the trench



with concrete to encase the metal duct work. The motor and blower unit are then connected. Car exhaust is fed through flexible tubes to the exhaust duct.

LITERATURE AVAILABLE—Illustrated folder.

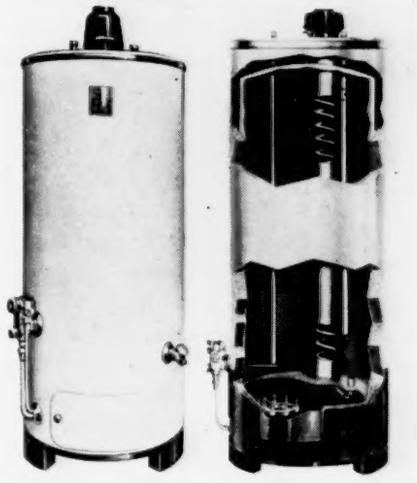
MADE BY—*The National System of Garage Ventilation, 330 N. Church St. Decatur, Ill.* **341**

Water Heater

NAME—Thomas Coil-O-Matic.

PURPOSE—For providing domestic hot water.

FEATURES—Water circulates through the Coil-O-Matic unit and is deposited at the top of the tank. Burner does not come in contact with the coil. Unit consists of 27 ft of ¾-in. copper tubing coiled in the stack and makers claim that up to 75% of the stack heat normally wasted in most heaters is utilized. Heater has an extra heavy an-



nealed steel tank galvanized inside and out, an anti-rust rod to eliminate red water, thermostat, safety controls and pilot, burner and flush out control valve for back washing.

SIZES AND CAPACITIES—33-150 gal.

MADE BY—*Thomas Heater Mfg. Co., Grand Blanc, Mich.* **342**

Convector

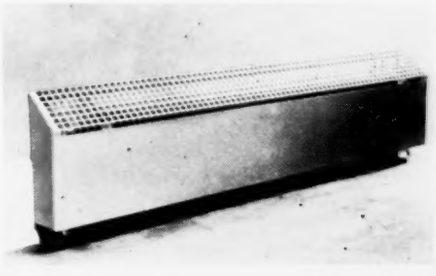
NAME—Rempe wall panel type convector.

PURPOSE—Space heating for a large area.

FEATURES—Convectors, which can be installed above or in the baseboard of a room or factory, consist of fins 3 in. wide by 6 in. high with two steel tube circuits passing through the section. Fins are of steel or aluminum. Slanted cover fits close to make a compact unit.

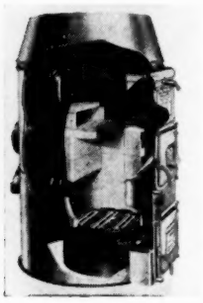
SIZES AND CAPACITIES — Made in sizes from 18 to 116 in. in length; height, 8 in.; depth, 3 in.

MADE BY—*Rempe Co., 340 N. Sacramento Boulevard, Chicago 12, Ill.* **343**



Furnace

NAME—Lennox coal-fired steel furnace.
PURPOSE—Space heating.
FEATURES—Makers claim that all volatiles from burning coal are pulled downward over a live coke bed where sufficient air is supplied for ignition. Air for combustion is accurately and automatically controlled by the room thermostat, motor driven dampers, and a barometric draft control. A high limit bonnet control switch is installed for additional safety. Round or square cased models are available.



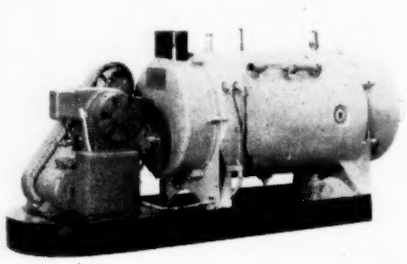
SIZES AND CAPACITIES—55,000, 70,000 and 100,000 Btu at bonnet for gravity or forced air operation.
MADE BY—*Lennox Furnace Co., Marshalltown, Iowa.* **344**

Smoke Control

NAME—Electronic smoke indicator.
PURPOSE—To control over-fire air in order to prevent smoke in coal burning furnaces.
FEATURES—Light source and eye box are of aluminum construction and are dust-tight. A tripod support on the light source permits adjustment on the direction of light beam. A built-in voltage regulator safeguards precision indication. Since control is electronic, relays and other moving parts have been eliminated.
OPERATION—A light beam is projected across a boiler or furnace flue to shine on a photo-tube which measures the smoke density. When this density increases beyond a pre-determined amount, a red warning light flashes and a timer relay circuit is closed. This, in turn, starts the over-fire air jets to operate and these jets remain on for the period of time for which the time relay circuit is set. Upon completion of the time cycle the jets are turned off. If smoke returns the entire cycle is repeated. Time is adjustable from 20 sec. to 20 min.
LITERATURE AVAILABLE — Bulletin No. 20-A.
MADE BY—*Brooke Engineering Co., Inc., 4517 Wayne Ave., Philadelphia 44, Pa.* **345**

Water Heater

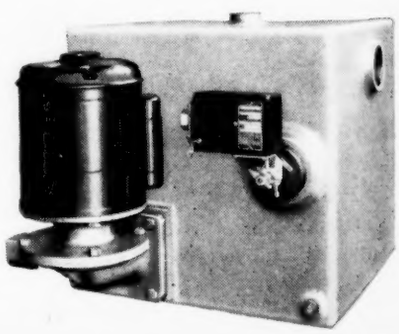
NAME — Cleaver-Brooks hot water generator.
PURPOSE — For the generation of large quantities of hot water to meet large commercial and industrial needs.



FEATURES — Units are completely automatic and are available in oil or gas fired models. Makers claim that the four-pass construction of the hot water generator shell insures high rating and efficiency. A hinged rear door lined with refractory provides accessibility for cleaning and maintenance. Generator shell, including the tubes, is completely galvanized. The outside of the shell is covered with a thick insulation jacket. Front end of the base, including the burner, can be removed for separate handling where required. Unit is constructed in accordance with the A.S.M.E. Code.
SIZES AND CAPACITIES—Unit is 113 in. long, 44 in. high, and 26½ in. wide. Available in two sizes, 550,000 Btu output, or 665 gal per hr delivery at 100F rise; 730,000 Btu output, or 875 gal per hr delivery at 100F rise.
MADE BY—*Cleaver-Brooks Co., 326 East Keefe Avenue., Milwaukee 12, Wis.* **346**

Condensation Pump

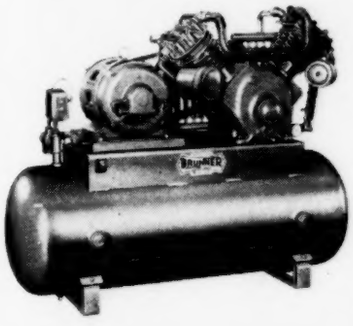
NAME—Sterling condensation pump 4100 series.
PURPOSE—For handling condensate.
FEATURES—All parts, such as motor, pump, float switch, and drain plug, are accessible from the front for quick servicing. By removing four cap screws, motor and impeller assembly may be lifted from the pump housing without disconnecting piping. A two-piece bronze impeller construction has been designed for this unit. Impeller is fitted with an oversize carbon type rotary seal. Since this seal runs on the impeller hub, it is said that motor shaft is not exposed to corrosion by condensate. Capacitor-start ¼-hp motor is dynamically balanced for quiet operation. Condensate is collected in a heavy 15-gal. steel tank. A built-in strainer protects pump from clogging. Levels are controlled with a non-corrosive float set to a single pole float switch.
SIZES AND CAPACITIES—Rated to handle any capacity up to 6000 sq ft E.D.R. (9 gpm) against a discharge pressure up to 20 lb.
MADE BY—*Sterling, Inc., 3743 N. Holton St., Milwaukee 12, Wis.*...**347**



Air Compressor

NAME — Brunner two-stage model air compressor.

PURPOSE—For use in industrial applications.



FEATURES—Cylinders and heads are of deeply-finned cast iron. Compressor is cooled by blast of air from fan bladed flywheel. Crankshaft is counterbalanced for elimination of vibration. Intercooler and aftercooler have extended surface, finned copper tubing. Air intake noise is said to be reduced to a minimum by use of a muffler which can be disassembled for cleaning. Valves, controls, and drain cocks of this outfit are grouped in manifolds readily accessible. Assembly is provided with heavy duty motor of 15 hp. Compressor is driven through V-belt drive. Slide rails are provided for easy belt adjustment. Automatic air release prevents motor from starting against overload.

SIZES AND CAPACITIES—Two-stage, 15-hp unit with a displacement of 72.5 cfm.

MADE BY—*Brunner Manufacturing Co., Utica 1, N. Y.* **348**

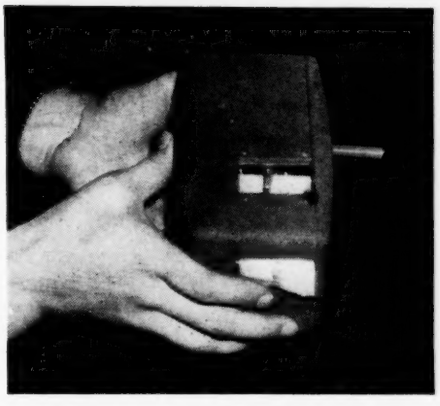
Vibration Measurement

NAME—Recording vibrometer.

PURPOSE — For measuring vibrations.

FEATURES—Unit is built to operate either on a fixed base or to be held in the hands. Unit weighs only 7 lb and is less than 8 in. in length. It was developed for testing reciprocating and rotating machinery within a vibration frequency range of 10 to 120 cycles per second.

OPERATION—A prod which extends from one side of the unit is set in motion when held against a vibrating body. This motion is amplified by a cross-spring arrangement and is transmitted to a stylus which inklessly records the vibration on wax paper. Another stylus produces a timing mark near the edge of the paper every one-third of a second. Both the chart speed and the interval between timing marks are governed by a synchronous motor operated from a 115-volt, 60-cycle power supply. Two push buttons enable chart speeds of 1 in. or 3 in. per second. Motion of the stylus can be observed through a window in the top of the all-aluminum case.



LITERATURE AVAILABLE — Bulletin GEC-310.

MADE BY — *General Electric Co., Schenectady 5, N. Y.* **349**

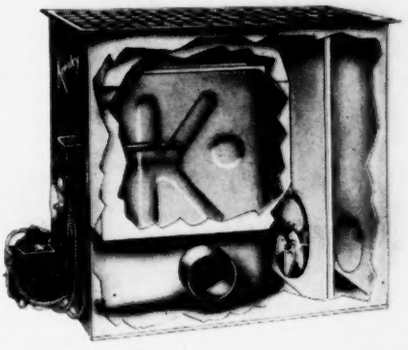
Floor Furnace

NAME—Evenheat model EVF.

PURPOSE—Space heating by means of an oil burning floor furnace.

FEATURES—Positive warm air circulation is provided by two blowers that are a part of the furnace. One blower supplies the proper amount of air for complete fuel combustion regardless of the natural draft condition, to make possible an immediate delivery of heat when the furnace is in operation. A circulating fan, suspended in rubber for noise-free operation, forces circulation of a large volume of warm air, it is claimed, to all parts of the rooms. Unit is complete with thermostatic controls and a variable speed burner control to maintain the proper blower speed for the amount of fuel being consumed. Heating element is constructed of 14- and 16-gage steel with all seams electrically welded.

SIZES AND CAPACITIES—Unit measures 20 by 36 in. and only requires 36 in. of subfloor space. Tested



output is 72,850 Btu per hr. Available in the flat floor type and also in dual wall register type.

MADE BY—*Kresky Manufacturing Co., Petaluma, Calif.* **350**

Furnace Control

NAME—Cam-Stat single unit furnace control.

PURPOSE—Control to serve as air limit and fan control.

FEATURES—Unit serves to limit maximum furnace temperatures and to control the fan on forced air furnaces and unit heaters. Total range of the air limit control is 100 to 300F with a 10-deg. differential. Range of the fan control is 100 to 165F cut-in temperature with a 15-deg. differential. A summer position is also provided to allow operation of the fan for ventilating purposes when heat is not required.

SIZES AND CAPACITIES—5⅜ x 2⅞ x 2¼ in.

MADE BY—*Cam-Stat, Incorporated, 2310 So. La Cienega Blvd., Los Angeles 34, Calif.* **351**

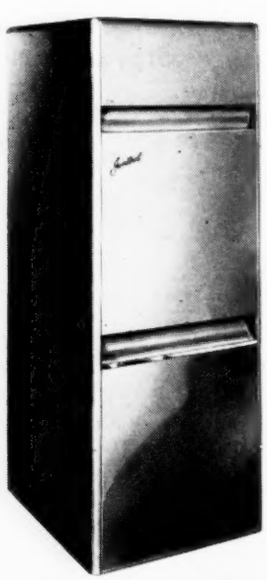
Steam Trap

NAME—No. 070 steam trap.
PURPOSE—Trap designed especially for applications where small drainage is a problem.

FEATURES—Unit has a renewable seat which can be removed for servicing, a stainless steel bucket, and an especially designed orifice for greater capacity. Unit is recommended for industrial unit heaters up to 150,000 Btu and for certain industrial and kitchen equipment.
MADE BY—*Strong, Carlisle & Hammond Co., Cleveland, Ohio.* **352**

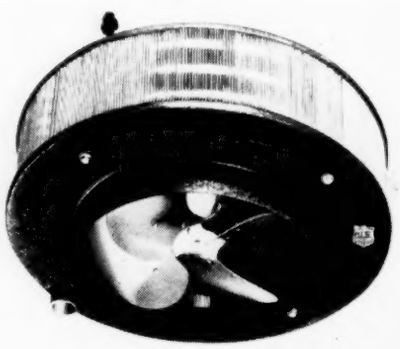
Furnace

NAME—Janitrol winter air conditioner.
PURPOSE—Warm air space heating.
FEATURES—Improved design of unit includes a redesigned burner chassis which is easily removable. Each ribbon burner releases as a complete unit. A top plate flue collector permits cleaning of the heat exchanger tubes. This unit has a new type plug-in self positioning pilot, cushioned suspension of the blower assembly, and a cabinet which encloses all controls and parts.
SIZES AND CAPACITIES—Six sizes ranging from 60,000 to 180,000 Btu per hr input rating.
MADE BY—*Surface Combustion Corp., Columbus, Ohio.* **353**



Unit Heater

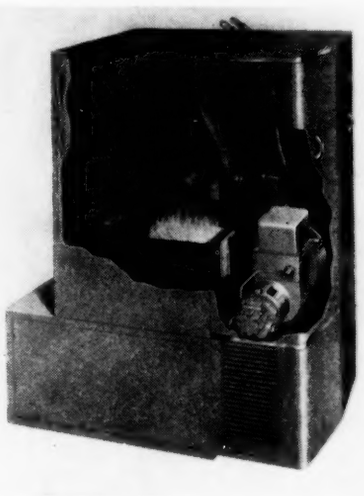
NAME—U. S. unit heater.
PURPOSE—Space heating.
FEATURES—Heater, designed for ceiling mounting, has a fan and motor assembly which is easily removed for servicing. It is made for either steam or hot water heating. Unit has large broad blade propeller fans and the motors are resiliently mounted in rubber.



SIZES AND CAPACITIES—Available in 28 sizes with heat output from 37,200 to 492,000 Btu per hr.
MADE BY—*United States Radiator Corporation, 300 Buhl Building, Detroit, Mich.* **354**

Furnace

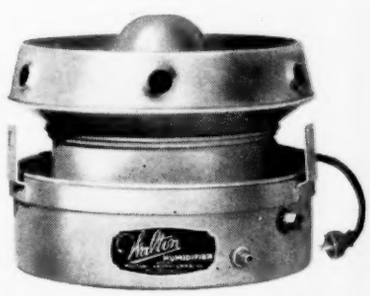
NAME—Chrysler Airtemp FLF-90 oil-fired winter air conditioner.
PURPOSE—Space heating of the small home.
FEATURES—Unit has a Chrysler Airtemp pressure atomizing oil burner flange-mounted directly on the furnace. Blower assembly is rubber mounted for quiet operation. Blower is slow speed, dynamically balanced, centrifugal, multiple blade type. Two rectangular radiators are mounted in parallel, one on each side of the fire box to give long flue travel and ample surface to extract all possible heat from flue gases. Furnace is formed from heavy gage sheet steel. Unit, it is claimed, may be installed as close as 2 in. from combustible material.



MADE BY—*Airtemp Div., Chrysler Corp., 1119 Leo Street, Dayton 5, Ohio*.....**355**

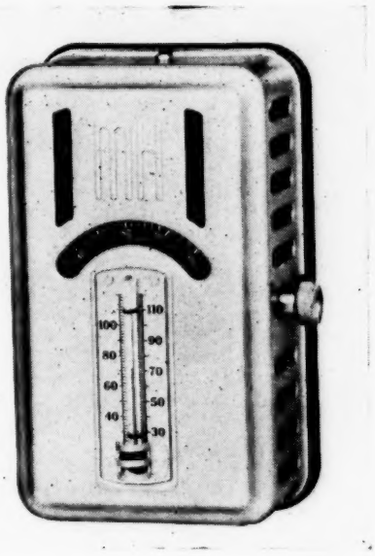
Humidifier

NAME—Walton humidifier.
PURPOSE—For adding moisture to the atmosphere.
FEATURES—Water flow level in unit is regulated by an automatic float assembly. A 60 watt motor is wired in series with a humidistat to assure completely automatic operation. Unit can be suspended from the ceiling or installed on a wall bracket.
SIZES AND CAPACITIES—Evaporates about ½ gal of water per hr. Height, 10½ in. and width, 13½ in.
MADE BY—*Walton Laboratories, Inc., Irvington, N. J.* **356**



Thermostat

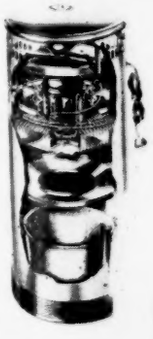
NAME — Minneapolis - Honeywell Type T220A thermostat.
PURPOSE—For regulating greenhouse temperatures.
FEATURES—Unit has provision for



altering the cycling rate and has a wide range temperature setting scale. A large scale and pointer and the adjustment knob facilitate accurate temperature setting. Bellows and other metal parts are treated to resist corrosive effect of humid atmospheres. A sealed mercury switch is provided for positive operation.
MADE BY—*Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.* **357**

Dehumidifier

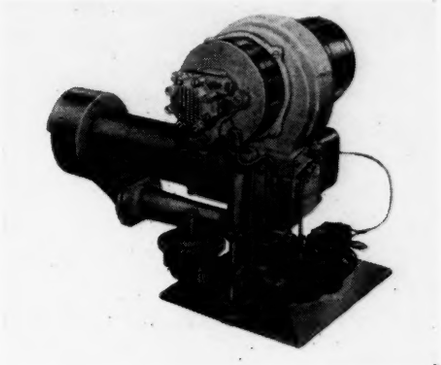
NAME—Frigidaire dehumidifier.
PURPOSE—To reduce humidity in basements, libraries, and for places of light commercial applications, by means of a refrigeration cycle which condenses air moisture.
FEATURES—Circular unit is provided with a fan to draw the moist air over a series of cooling coils which removes the moisture and condenses it into water droplets which are, in turn, deposited in a container or drain. Dehumidifier requires no special connections and operates on standard 110 volt current. Unit is portable and can be easily moved from one room to another. Unit measures 33⅝ in. high and is 14 in. in diameter.



MADE BY—*Frigidaire Division, General Motors Corp., Dayton 1, Ohio.* **358**

Gas-Oil Burner

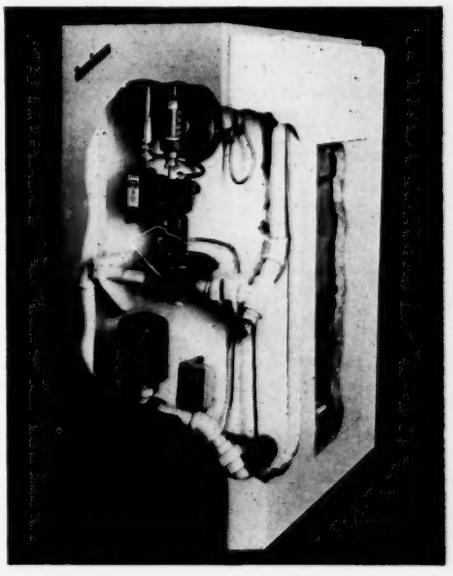
NAME — Dual-a-Fire conversion burner.
PURPOSE—Automatic firing which permits burner to operate on gas during periods when the outside weather conditions are not too severe, or when gas utility can handle load, and to burn oil when the gas utility reaches its peak load.
FEATURES—Unit consists of two



separate systems, so arranged with alternate damper arrangements to function in response to outside weather conditions' demand for gas or oil consumption. Each has its own controls and operates under its own stack conditions. Electric ignition is provided for both the gas and the oil cycle. Once the main line switch is on and the weatherstat preset by the utility company, the controls are fully automatic. The burner has an input of 175,000 Btu per hr when burning gas, and an input of 3 gal per hr when burning oil. The oil burner is of the gun type operating on No. 3 oil while the gas burner is of the atmospheric type. Unit can be set for burning only gas or only oil as conditions dictate. A ¼-hp blower motor, operating at 1725 rpm, drives a 12-in. diameter, 12-in. wide blower wheel.
OPERATION — When room thermostat calls for heat the oil pump and blower motor are started and the fuel is ignited. Should the fuel fail to ignite the oil, pump guard shuts off the oil pump motor. When the weatherstat calls for operation of the oil burner a damper control system shuts off the gas pilot valve and locks the main gas valve shut while the oil pump guard takes over.
MADE BY—*Automatic Firing Corp., 6500 Olive Boulevard, St. Louis 5, Mo.* **359**

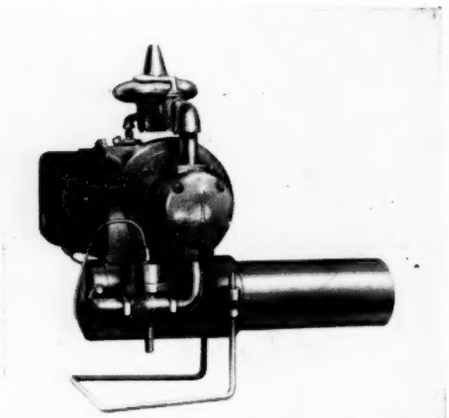
Gas Boiler

NAME—Burnham gas boiler, Model 22.
PURPOSE—Space heating and generation of domestic hot water.
FEATURES—Boiler section is of cast iron with vertical finned flue passages. A thermostatic pilot is placed close to the access door at knee level for easy lighting and inspection. Burners are of cast-iron raised port Bunsen type which can be easily removed through the access panels. A gas manifold extends the length of the boiler and permits use of identical burners under each flueway on a wet base boiler. All air, both primary and secondary, is thermostatically controlled. A copper tankless heater is installed submerged at the hottest point in the water inside the boiler.
LITERATURE AVAILABLE—Folder.
MADE BY—*Burnham Corporation, Irvington, N. Y.* **360**



Gas Burner

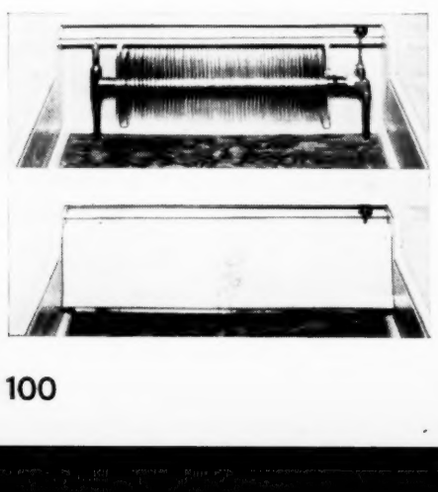
NAME—Lo-Blast Economite.
PURPOSE — Gas conversion burner for domestic installations.
FEATURES—The unit uses a 1/40-hp motor blower which provides a



sufficient amount of air for combustion regardless of draft through the furnace. It also has electric ignition with interlocking safety pilot control. Burner can fire into a refractory chamber or optional stainless steel chamber. Parts are easily accessible for servicing. Unit is provided with a pilot safety, blower safety, and a mechanical main valve shut-off. It is designed to burn natural manufactured, and L.P. gases.
SIZES AND CAPACITIES—From 75,000 to 150,000 Btu input.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY — *Mid-Continent Metal Products Co., 1960 N. Clybourn Ave., Chicago 14, Ill.* **361**

Baseboard Panel

NAME—Basepanel radiation.
PURPOSE—Space heating by means of finned coil behind basepanel.
FEATURES—Fins on ¾ in. I.D. copper tubing are ribbed to provide added strength and air turbulence through fins. Baseboard cover is made of heavy gage steel and is so constructed that it can be removed to clean the coils. To assemble cover, cut it to length, hook top lip over bracket catch, grasp spring at bottom and put in bottom curved bead. Spring also compensates for variation in floors and wall. No recessing is required. Brackets are nailed through plaster to studs. Standard package contains 4½ ft finned coil; coverpanel, 5 ft long; air deflecting center strip 5 ft long; and three coil and panel mounting brackets.
MADE BY—*Brown Electric Co., 96-08 72nd Avenue, Forest Hills, N. Y.* **362**

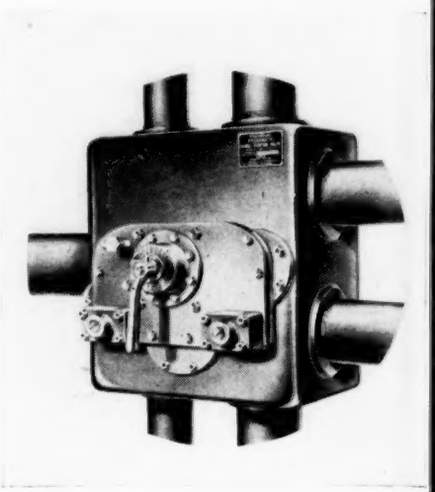


Soot Remover

NAME—Nalco SR-150.
PURPOSE—Chemical soot remover.
FEATURES—Powder is said to remove soot by lowering its ignition temperature to 775F where normal furnace temperatures will burn off the deposit. Compound may be fed to the furnace under normal operating conditions and the powder vaporizes on contact with the fire bed.
LITERATURE AVAILABLE—Booklet.
MADE BY — *National Aluminate Corp., 6220 W. 66th Pl., Chicago 38, Ill.* **363**

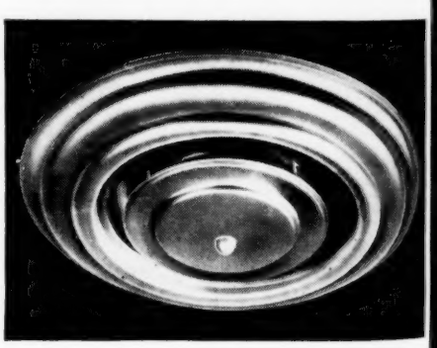
Control Valve

NAME—Cochrane hydromatic control valve.
PURPOSE—Single control valve for simplified operation of zeolite water softeners.
FEATURES—Unit is a six-position valve with four normal operating positions and two standby positions. In the control of the zeolite water softening systems, the four operating positions provide separate control of backwash, regenerant feed, rinse and service to provide great flexibility so that separate flow rates may be assigned to each of these operations. Two standby positions are available. Valve is pilot-actuated, with the power for the operation of the valve being provided by the water itself. A number of pilot valve members control the various functions.
MADE BY—*Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32, Pa.* **364**



Anti-Smudge Cone

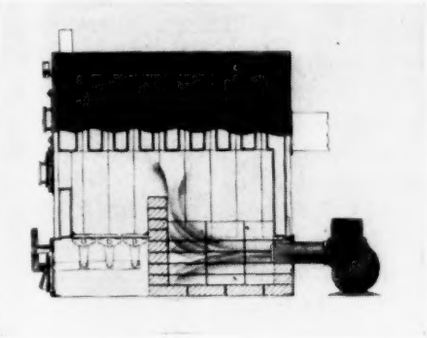
NAME—Kno-Draft adjustable air diffuser.
PURPOSE — To prevent smudge marks on the ceiling resulting from air diffuser.
FEATURES — Cone fits securely in the Kno-Draft diffuser between the outer rim of the diffuser and the ceiling and is said to eliminate ceiling smudge. Cones require less space between the face of the duct and the finished ceiling. Less care is required in cutting ceiling openings for the air diffuser. Rubber



gaskets are available for the joints between cone and diffuser or ceiling.
SIZES AND CAPACITIES—Kno-Draft diffusers with neck diameters from 4 to 18 in.
LITERATURE AVAILABLE — Bulletin K-22.
MADE BY—*W. B. Conner Engineering Corp., 114 E. 32nd St., New York 16, N. Y.* **365**

Boiler

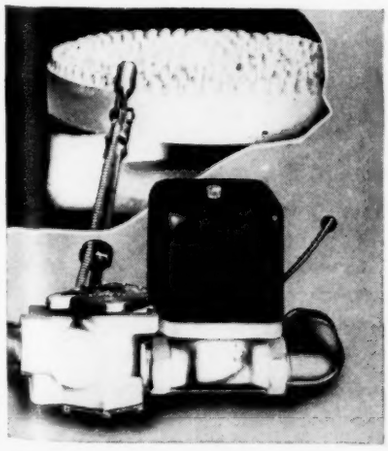
NAME—Reliance oil burning boiler.
PURPOSE—A heating boiler designed for automatic firing but with a special emergency grate for use when burning coal.



FEATURES—Grates have been included at the front end of the boiler. Provision is made at the rear end for a combustion chamber for oil burner, stoker or gas burner. During normal operation, grates are covered with insulation board in order to prevent air leakage. Should a power failure occur, insulation is easily removed and a fire built on the grates. Hand-fired operation is provided for an emergency measure. The grate is of sufficient size to maintain livable conditions during such time as the normal power may be off to make the automatic burner inoperative.
LITERATURE AVAILABLE—Illustrated bulletin.
MADE BY—*The H. B. Smith Co., Inc., Westfield, Mass.* **366**

Furnace Control

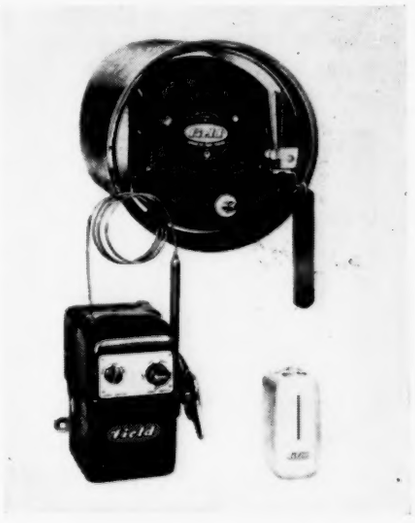
NAME—Furnace Gasapack.
PURPOSE—Gas control for furnaces and space heaters.



FEATURES—One unit has been designed to replace hand cock, automatic pilot, motorized valve and limit control. Manual opening switch permits operation of heater if current should fail. A limit control overrides the manual turn-on if the bonnet temperature rises above the switch opening. When the current is restored, the manual switch is automatically returned to the off-position. No gas can flow through the valve if the pilot light is off.
SIZES AND CAPACITIES—65,000 Btu per hr for manufactured gas and 90,000 Btu per hr for natural gas.
LITERATURE AVAILABLE—Illustrated booklet.
MADE BY—*Automatic Products Co., 2450 N. 32nd St., Milwaukee 10, Wis.* **367**

Furnace Control

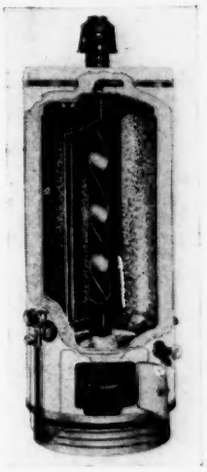
NAME—Field fuel saving system.
PURPOSE — System of automatic controls for hand-fired furnaces.



FEATURES — The entire system, complete with thermostat, damper motor, and Barocheck, is contained in a package. Prewired for plug-in installation. Built-in limit switch is an integral part of the damper motor, to prevent overheating and to assure more precise temperature control. A Stoke-switch holds the drafts open while the furnace is being charged and automatically returns control to the regular thermostat. A booster fan switch is provided in the damper control for hooking up a Buck-wheat coal burner or similar combustion air blower. The thermostat is provided with a heat anticipator to prevent overshooting temperature.
MADE BY—*Field Control Division, H. D. Conkey Company, Mendota, Ill.* **368**

Water Heater

NAME—Automatic water heater.
PURPOSE—For the generation of domestic hot water.
FEATURES—Unit has a drilled, raised-port burner, spiral baffled internal flue, Grayson unitrol dial temperature control, and Fiberglas insulation. The tank is of Norsteel. Burner is located in the center of the base and the internal flue is off center in the tank to provide a flame wiping action on the bottom of the tank. The Deluxe model is provided with a magnesium anodic rod. Burner is for natural, manufactured and L.P gases.



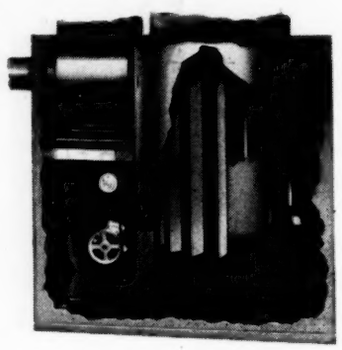
SIZES AND CAPACITIES—20, 30, 45 and 66 gal.
MADE BY—*Norge Heat Div., Borg-Warner Corporation, 672 E. Woodbridge, Detroit 26, Mich.* **369**

Electrode

NAME—Softweld.
PURPOSE—Electrode for depositing dense, soft machinable welds in gray iron castings.
FEATURES—This is a non-ferrous electrode and operates with a soft steady arc on either alternating or direct current. It is designed to cause the weld to flow over and bond to the cast iron with a minimum of penetration and heating of the base metal. Weld area, it is claimed, may be drilled, machined, sawed, or tapped with ease.
MADE BY—*The Lincoln Electric Co., Cleveland 1, Ohio.* **370**

Furnace

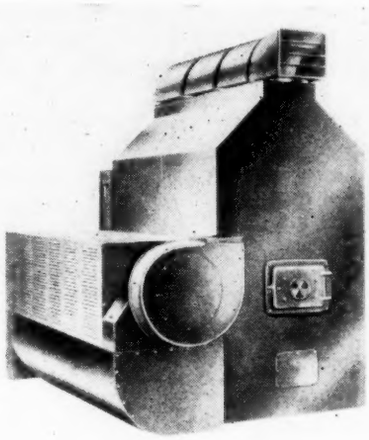
NAME—Gillen oil burning furnace.
PURPOSE—Space heating.
FEATURES—Warm air circulation is provided by a three-stage flame



controlled by a Mercoid thermostat. Unit has a modulated pilot, a medium and a high flame. The high flame burns only during periods of zero or sub-zero temperatures. Burner compartment contains a 13-in. burner and controls are mounted as a single unit which is easily accessible. Both combustion blower and circulating blower are rubber mounted. There is a built-in anti-flooding device, blower switch and limit control. Combustion chamber measures 18 in. and includes a secondary heating surface to give fast heat transfer. A large heat exchanger warms the returning cool air.
SIZES AND CAPACITIES—80,000 Btu output.
MADE BY—*J. L. Gillen Co., 204 E. High St., Dowagiac, Mich.* **371**

Space Heater

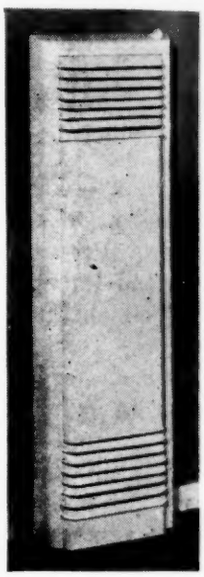
NAME—Dravo Counterflo coal-fired warm air space heater.
PURPOSE — Coal-fired space heater which can be converted for either gas or fuel oil.
FEATURES — Unit has a stainless steel combustion chamber. Operation of unit is based on the same warm air recirculation principle as the present Dravo Counterflo heaters. Air is drawn into the base, passed over economizer tubes and the combustion chamber and discharged through overhead nozzles. Heater can be used with or without ducts and can be adapted to bring in and heat outside air for applications that require an arrangement for tempering makeup air. Standard equipment with the heater includes a hopper model bituminous coal stoker. Anthracite or bin-feed stokers can also be supplied. Blowers and an induced draft fan are mounted on a single heavy shaft driven by a single motor. Fans, bearings, and motor are located at floor level. Free access is provided to the firing and for removal of ash and clinkers and to the economizer tubes and exhaust system for cleanout of fly ash. Operation of fans and stoker is controlled by room thermostats. A timer operates the stoker for short periods to maintain fire during mild weather. All controls are located in one control box, and can be operated for summer ventilating or drying.
SIZES AND CAPACITIES—Two output capacities of 1,250,000 and 1,500,000 Btu per hr.



MADE BY—*Dravo Corporation, 5th and Liberty Aves., Pittsburgh 22, Pa.* **372**

Wall Circulator

NAME — Williams Warmolator, model 20.
PURPOSE—Space heating for rooms and offices.
FEATURES—A vented wall type gas-fired heating unit has been designed to use natural, manufactured or L.P. gas. Unit fits between 2 x 4-in. studs on 16-in. centers without furring or special framing. It is vented through the wall by means of an oval 4-in. flue. Heating element has an air cooled finger-type cast-iron burner and a heavy gage fin-heating element. A control knob is located at the top of the unit. Safety is provided by an automatic safety pilot and a fully shielded heating element.



MADE BY—*Williams Radiator Co., 1821 Flower Street, Glendale, California.* **373**

NOVEMBER, 1948

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

333	334	335	336	337	338	339	340	341
342	343	344	345	346	347	348	349	350
351	352	353	354	355	356	357	358	359
360	361	362	363	364	365	366	367	368
369	370	371	372	373				

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Name.....

Title (Must be shown).....

Firm (Must be shown).....

(For prompt service, title and firm name must be shown above.)

Business Address .....

City.....Zone....State..... 11-48

NEWS OF THE MONTH

AIR POLLUTION BILL

for New York City is opposed by 20 of 45 attending City hearing.

The New York City Council's Committee of General Welfare heard 45 speakers at a public hearing on a bill by Council Vice-Chairman Joseph T. Sharkey, Democrat, of Brooklyn, to establish an air pollution control bureau in the Department of Housing and Buildings. Twenty-five persons were in favor of the bill and 20 were opposed.

The Sharkey bill would set up a control board of five members to work out a code of regulations to control smoke nuisances and other offenses that contribute to air pollution.

Among those objecting to the bill were representatives of the Association of Eastern Railroads, the Fifth Avenue Association, the Twenty-Third Street Association, The Real Estate Board of New York, and the New York Oil Heating Association.

• **OBJECTION.**—Thomas J. Miley, executive vice-president of the Commerce and Industry Association, pointed out in a letter to *The New York Times* that his association is in complete agreement with those expressing the need for a much better job in air pollution control. The association's objection to the Sharkey bill was that it would set up an entirely new and expensive enforcement agency duplicating and overlapping functions and duties of other city departments. Present conditions, according to Mr. Miley, are not the result of inadequate legislation but rather the lack of sufficient personnel to enforce existing laws.

• **HEALTH.**—Since air pollution affects the public health, the association believes the Health Department is the proper agency to combat it. The association's recommendation is that the Health Department's budget be increased to provide for sufficient inspectors assigned to air pollution exclusively. Furthermore, the sanitary code, under which the Health Department operates in dealing with air pollution, forbids emission of dense smoke without defining density of smoke. Mr. Miley's recommendation was to amend the sanitary code to define dense smoke in terms of the Ringelman scale, a method successfully employed in statutes presently in force in both Pittsburgh and St. Louis.

The Sharkey bill's provision for creation of a separate bureau within the Department of Housing and Buildings and within that bureau a five-man board with power to promulgate regulations would be little more than to pile still another bureau on the city's already topheavy administrative machinery and would add an estimated quarter of a million dollars to the cost of operating the city government, says Mr. Miley.

• **OIL BURNERS.**—The oil burner industry alone estimates that within the next twelve months it will make about 35,000 installations. Under the Sharkey bill, 175,000 individual processes would have to be made in connection with only this one phase of combustion equipment installation. These processes would result from dual applications and permits required by the Sharkey bill. Mr. Miley expressed the view that the aims of the Sharkey bill would best be served by amendment and enforcement of existing laws.

GAS INDUSTRY

reveals new developments in production and controls. Award winners announced.

An operating pilot plant of a new gas producing process to meet peak load requirements of gas utilities and a new control for single point ignition were demonstrated at the Gas Appliance Manufacturers Association Exhibition held in Atlantic City October 4 to 8 in conjunction with the 30th annual convention of the American Gas Association.

• **PILOT PLANT.**—A catalytic cracking process for fuel gas production, was installed early in January of this year in the Riverhead plant of the Long Island Lighting Co. The process, demonstrated in a pilot plant at the exposition by Surface Combustion Co., provides a means of meeting the peak load demand without excessive investment in equipment and transmission facilities. The process converts a wide variety of feed stocks, together with air and steam, into a gas having almost any desired combination of specific gravity and Btu value. The gas so produced can be used by the gas company to match the gas regularly supplied through its mains to the customers.

Commercial propane was used by Surface Combustion engineers in their demonstration plant at Atlantic City, to supply many different types of fuel gas, as requested by visitors to the exposition. The gas so produced was burned off in a flare over the pilot plant.

• **IGNITION CONTROL.**—For the first time since the beginning of a long research and development program in 1930 by the metallurgical laboratory of the Peoples Gas Light and Coke Co., a new and novel control for gas ranges was demonstrated at the Atlantic City exhibition.

The new development, Curie point controls for single point ignition, was presented to convention delegates by Cribben & Sexton, Hardwick Stove Co. and Penn Electric Switch Co.

In 1938 the metallurgical laboratory of Peoples Gas Light set out to investigate the magnetic properties of alloys under varying conditions of temperature. The starting point of this study was based on data contained in a thesis by Pierre Curie in 1895.

Curie point metals are carefully prepared alloys of iron and other elements characterized by their mag-

netic properties. When a Curie point metal is *below* its Curie point temperature, it is magnetic and is therefore readily attracted to a magnetic force. When a Curie point metal is *above* its Curie point temperature, it is non-magnetic and does not respond to any magnetic force. By experimenting with alloys having various constituents it was found that an alloy could be created which would go through this magnetic change at a predetermined temperature, and this property remained a permanent characteristic of the metal.

The results of Peoples' investigation under R. A. Wittmann made possible the "know-how" for developing a series of Curie point alloys which have magnetic changes ranging from 180F to 800F. These metals can be machined and handled in any way without effect on the metallic structure or performance characteristics.

Up to the time the war broke out in 1941, this work had progressed to a point where a number of specific applications had been developed and patented. Most of these devices were designed to make use of the Curie principle in a small magnetic gas valve which opens and closes in response to heat. These devices can therefore be applied to any gas appliance requiring automatic operation or safety controls. Some of the patented applications are: Automatic safety pilots, actuators for gas control valves, actuators for switch operated control valves, direct acting limit or control switches, and automatic lighter systems for gas ranges. During the war period this entire project remained inactive.

Then the laboratory released all interest and patent rights to R. A. Wittmann with the mutual understanding that he would exploit its possibilities for use by the industry in general.

Mr. Wittmann continued to carry on development work on Curie point, giving particular attention to its use on gas ranges as a means for single point automatic ignition. Through the cooperation of two prominent range manufacturers, Hardwick Stove Company and Cribben & Sexton Company, who have agreed to pioneer the final application work, and through the Penn Electric Switch Co., a control manufacturer who has retained Mr. Wittmann for completion of the development, a basic research program has progressed to a point where a new and novel control for gas ranges will soon be available for general use. This control is for single point ignition for gas ranges.

• **AWARD WINNERS.**—Individual achievement in the field of creating, maintaining and increasing consumer demand for gas house heating was recognized at the AGA convention. Three gas utility men were announced as winners of the second annual AGA Gas Heating Progress Award sponsored by The Coroaire Heater Corp.

L. J. Fretwell, chief commercial engineer, Oklahoma Natural Gas Co., Tulsa, Okla., was awarded first prize of $500 for his practical and effective program to upgrade gas heating installations and servicing.

AGA Gas Heating Progress Award jury (l to r): Harold Massey, GAMA; Clifford Strock, HEATING AND VENTILATING; E. P. Kramer, Ebasco Services, Inc.; H. A. Dickman, The Brooklyn Union Gas Co.

The program for which Mr. Fretwell was cited is an educational plan for dealers, builders, city inspectors and the consuming public. It also included adoption and enforcement of model ordinances on correct heating installations.

Second prize of $250 went to W. E. Davis, assistant general sales manager, Equitable Gas Co., Pittsburgh, Pa., for an outstanding dealer participation program to develop the gas heating market. Purpose of the program was to promote customer acceptance of high quality equipment and installation standards.

Third prize of $150 was awarded to Robert E. Ginna, vice-president in charge of sales, Rochester Gas and Electric Corp., Rochester, N. Y., for the aggressive forward-looking gas house heating program for utilities outlined in the paper "What To Do About House Heating," presented at the New Jersey Gas Association's annual convention. In this paper Mr. Ginna advocated greater efforts by the utilities to serve the house heating customers, more research, and a more realistic attitude toward the future development of gas house heating.

• **HOME SERVICE.**—Outstanding individual accomplishments in the gas utility home service field were recognized at the convention when five winners of the nationwide AGA Home Service Achievement Award sponsored by McCall's Magazine were announced. Cash prizes totaling $1,000 and bronze plaques were presented to the winners at the second general session of the convention.

Honors were awarded to Helen Kirtland, home service director, The Ohio Fuel Gas Co., Columbus, Ohio; Mrs. Arra Sutton Mixter, home service director, The Hartford Gas Co., Hartford, Conn.; Lois Dinneen, home service division, Equitable Gas Co., Pittsburgh, Pa.; Mrs. Nellie Oxrider, director of home service, The Dayton Power & Light Co., Dayton, Ohio, and Florence Wren, home economics adviser, Public Service Electric and Gas Co., Englewood, N. J. Each of the winners received $200 and a bronze plaque.

• **GAS AIR CONDITIONING AWARD.**—The first annual American Gas Association Progress Award for Gas Summer Air Conditioning, sponsored by Servel, Inc., was presented to the Southern California Gas Company, Los Angeles. The award provides national recognition to the gas utility company judged to have made the greatest contribution during the year to the advance of gas summer air conditioning.

A check for $1,000 and a plaque were presented to the winning company. In addition, gold-plated replicas of the plaque were given to A. F. Michael, general supervisor of air conditioning sales, and 14 other members of the Southern California Gas Company who contributed to the award. The Jury of Awards consisted of H. P. Morehouse, Public Service Electric and Gas Co., Newark, N. J., chairman; L. L. Ladewig, Houston Natural Gas Corp., chairman, A.G.A. Gas Summer Air Conditioning Committee; Harold Massey, Gas Appliance Manufacturers Association; Prof. R. J. Martin, Department of Mechanical Engineering, University of Illinois; H. W. Springborn, managing editor, *Gas Age*, New York; and R. F. Taylor, Houston, Texas, representing the American Society of Heating and Ventilating Engineers.

KEEPING WORKERS COOL

with textile mill air conditioning is a good way to prevent disputes, according to CIO technical report for management.

Summer heat is going to be a collective bargaining issue in the textile industry. Although the season when management has to worry about summer shutdowns and work stoppages is over, the CIO's Textile Workers Union of America is starting to talk air conditioning with employers—and will take up the subject, if it has to, in contract negotiations, according to *Business Week*.

• **REPORT TO EMPLOYERS.**—Companies under contract with T.W.U.A. recently received from the union a 60-page technical report on "Air Conditioning in Textile Mills." In it, union president Emil Rieve urged that "employers who have not yet adopted (air conditioning) take it immediately under advisement and act on the suggestions" from the T.W.U.A.'s technical research workers.

The report warns that "poor products, high cost of manufacture, strikes, and labor-management controversy" are end results of "poor atmospheric conditions" in textile mills.

"Many plants already have established adequate controls over temperature and humidity," according to the report. "In terms of financial returns and better production alone, the benefits are sufficient to justify this program."

• **BACKGROUND.**—T.W.U.A. has been protesting "uncomfortable, exhausting temperatures and humidities" for several years. At its last convention, in April of this year, the union passed a resolution calling for controlled temperature and humidity in plants. Last summer's thermometer readings put heat into the union drive as well as into the mills.

Last June, the temperature hit 95F in weaving rooms of a North Carolina cotton mill. Workers walked out. The plant's humidifying equipment wasn't operating properly. T.W.U.A. representatives got the company to permit workers to open weave-room windows, and the walkout ended. One month later the company improved the equipment, and no further troubles developed during the hot summer. Production levels were high.

An Alabama plant, with a $500,000 air conditioning system, ran into labor troubles last July, when plant temperatures ranged between 102F and 109F. The union got workers to go back to their jobs. Since then it has been consulting with the company on how the air conditioning system can be made to work properly.

• **THE OUTCOME.**—These two situations were typical of summertime problems throughout the industry. So Solomon Barkin, union research director, and Franklin G. Bishop, its senior engineer, prepared a "realistic and practical" air conditioning manual for the textile industry. The aim: "To promote good labor-management relations by ridding the textile industry of problems arising from poor atmospheric conditions."

The manual advises that:

Worker efficiency is at a maximum when the "effective temperature" is about 70F; performance records dip sharply when the e.t. goes above 80F.

Machine efficiency is at a maximum in a textile plant when a constant level of relative humidity is maintained, through controls. The union says that this constancy can: (1) Do away with uneven spinning due to static electricity; (2) greatly reduce the number of broken ends; (3) stop losses from substandard products that result when fibers "become too dry and stiff or too moist and soggy."

• **RECOMMENDATIONS.**—T.W.U.A. engineers found that an e.t. maximum of 80F "will assure satisfactory conditions both for workers and textile processing."

More than half of the 60-page publication is devoted to the union's technical analysis of plans calling for use of: (1) atomizers; (2) window fans and atomizers; (3) saturated air from central station or units; (4) saturated air with supplemental atomizers; or (5) saturated air, supplemental atomizers, and refrigeration.

• **IN CASE THEY DON'T.**—But T.W.U.A. has an axe to grind in the current report: It wants on-the-job comfort for textile employees. The report, therefore, is being sent to local unions, too, with advice on how to use it to help in collective bargaining on air conditioning.

The report is also being sent to members of legislatures in textile states, along with a model for a proposed law to regulate ventilation, temperature, and humidity in mills.

PRESSURE PIPING CODE

to be revised. ASME announces reactivation of committee under ASA procedure. New code to appear in 1950.

The American Standard Code for Pressure Piping, safety standard for all steam and power services, is to be completely revised within the next two years, according to Frank S. G. Williams, new chairman of the committee which functions under ASME sponsorship. At an organization meeting, October 1, 1948, attended by representatives of more than 30 cooperating bodies, Mr. Williams, who is general manager of the Eastern Division of Taylor Forge and Pipe Works, announced plans for bringing the code abreast of current developments in the field of materials, design and construction.

• **SAFETY.**—Originally organized in 1926, the committee includes representatives of groups primarily concerned with safety of high-pressure piping systems. Members-at-large are recognized experts in the piping field. Sabin Crocker, consulting engineer of Ebasco Services, Inc., is vice-chairman, and L. W. Benoit of the Manufacturers Standardization Society of the Valve and Fittings Industry is secretary.

In his charge to the committee, Mr. Williams emphasized the character of the code as a safety code rather than a design specification. He stressed the need for making periodic interpretations when necessity arises.

• **ORGANIZATION.**—Committee operations will be directed, he explained, by an executive committee composed of chairmen of subcommittees, plus three to five members-at-large. This group would establish policies, supervise and coordinate, arrange publication and distribution of the code, administer subcommittee work and maintain liaison with other code-making bodies.

Specific subcommittees were appointed to revise sections of the code (1) power piping systems, (2) gas and air piping systems, (3) oil piping systems, (4) district-heating piping systems, (5) refrigeration piping systems, (6) fabrication, and (7) corrosion-service piping. A second group of subcommittees include (1) materials and stresses, (2) standards and identification, (3) instrument piping, (4) mechanical design, (5) liaison with ASME Boiler Code Committee, and (6) welding procedures and qualification.

Thus, the chairman announced, technical subjects which cross all fields of service, such as instrument piping and mechanical design, will be handled by separate technical committees. It is proposed to recognize liaison with overlapping of jurisdiction and achieve uniformity. For example, the committee will continue to look to American Society for Testing Materials for solutions to materials problems. A special committee on welding will keep its attention focused on developments in that field that affect the code.

The ASME Boiler Code Committee already has formed subcommittees to establish allowable stresses for materials. It is proposed to cooperate with this group rather than duplicate the activity.

An editing committee is charged with responsibility for uniformity of style and an indexing system for subject matter in each section of the code under uniform numerical references. This subcommittee also reviews incoming questions dealing with interpretation, makes a canvass of opinion among other subcommittees and recommends action to the executive committee. Interpretations may then be published as official interpretations of the code.

• **SPECIAL PROBLEMS.**—The field of "corrosion-service" piping is new to the committee. It includes stainless steel, nickel, Inco alloys, aluminum and copper. These materials, their use and methods of fabrication differ from steel to an extent that separate handling is justified. The chairman also suggested special study of the problems of operation at very low temperatures, below —20F, not now a part of the code.

The executive committee will meet at six-week intervals until the work is well under way. Address all communications to the Secretary, L. W. Benoit, Manufacturers Standardization Society, 420 Lexington Ave., New York 17, N. Y.

WARM AIR MEETING

will feature labor relations, business, and technical speakers in Cleveland.

The National Warm Air Heating and Air Conditioning Association will hold its 35th Annual Convention on Thursday and Friday, December 9 and 10, at Hotel Cleveland, Cleveland, Ohio. The Association has planned a program comprehensive in appeal to the business interests of manufacturing, wholesaling and retail-contracting phases of the industry.

Authorities in various fields of business administration will speak, and a special effort is being made to bring Senator Homer E. Capehart (R) of Indiana, chairman of the Senate Subcommittee on Trade Policies, to address the gathering on the much discussed basing-point system.

Atlee Wise, president of the Wise Furnace Co., Akron, Ohio, and president of NWAHACA, will deliver the convention's keynote address and introduce other speakers.

• **TAFT-HARTLEY.**—Wilbur R. Meredith, Cleveland industrial consultant and associate professor in Engineering Administration at Case Institute of Technology will speak on the subject "The Taft-Hartley Act—A Year Later" in which he will point up actual industrial experiences of the Taft-Hartley law in action.

R. A. Ellison, traffic manager of the Service Bureau Co., Cincinnati, Ohio, traffic consultants for the association, will outline the latest developments in the proposed uniform classification ratings on warm air heating products.

How to Bend REVERE COPPER WATER TUBE For Radiant Panel Heating

FORM your radiant heating coils on a temporary bench right on the job—it's easy! Just nail to the top of the bench narrow wood guide strips far enough apart to fit the tube and with the pairs spaced for the desired tube spacing in the panel. Then nail wood templates in place, properly lined-up for making return bends and located to produce the required over-all length of the coil.

The 60-foot coils of soft temper Revere Copper Water Tube can then be unrolled between the guide strips and around the templates to make sinuous coils.

Wherever possible make all soldered joints including headers right on the bench. After the coils are formed, it is an easy matter to lift them into position on the ceiling by means of a simple wooden jig which is temporarily fastened in place until the copper tube has been fastened to supporting members in a sufficient number of places to permit the frame to be removed.

In cases where the radii of the return bends are so short that there is danger of the copper tube collapsing during the bending operation, metal sheaves which support the tube wall around its entire circumference should be used in place of the wood discs. A metal handle having two pins for holding the sheaves in proper relation will be necessary for making the bends.

In addition to the ease with which you can bend Revere Copper Water Tube, you'll like this tube because its light weight makes it easy to handle. And, of course, soldered joints cut your installation costs.

Other Revere materials include Red-Brass Pipe; Sheet Copper and Herculoy for tanks, ducts, pans and trays; Dryseal Copper Refrigeration Tube (dehydrated and sealed); Copper oil burner, heat control and capillary tubes. All are handled by Revere Distributors in all parts of the country. The Revere Technical Advisory Service is always ready to serve you. Call your Revere Distributor. REMEMBER—Trouble always costs more than Revere Copper Water Tube.

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Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

• **SALES.**—Presenting the sales side of business will be "Sunshine Gene" Flack, sales counsel and director of advertising for Sunshine Biscuits, Inc., New York, N. Y. He will outline the urgent need for sales and promotion in today's business program in a speech entitled "The Time is Now!"

Also of sales interest will be "The Biggest Sales Job in All History" delivered by Hamilton Eames of Lincoln Publishers, Inc., New York, speaking in behalf of the American Economic Foundation. Mr. Eames is nationally known as the moderator of the popular "Wake Up, America" debates recently broadcast from coast-to-coast.

A special address outlining the place of the wholesaler in the heating industry will be given by John E. Phillips, treasurer of the Stelwagon Manufacturing Co., Philadelphia, Pa.

• **TECHNICAL.**—Speaking on recent developments in the Association-sponsored research program at the University of Illinois will be Robert W. Roose and Norman Buckley, special research assistants in mechanical engineering of the university. Mr. Roose will discuss the results of "Ceiling Panel Heating vs. Conventional Forced Warm Air Heating in the Research Residence with an Unheated Basement." Mr. Buckley will discuss "Performance of the Blower and Resistance of the Furnace when combined into a Blower-Furnace Unit" and "Balance of Branch Air Quantities and Air Temperatures when Total Air Quantity is Varied in a Winter Air Conditioning System."

ALUMINUM FOR DUCTS

approved by NBFU. Revised standards for installation issued.

The National Board of Fire Underwriters has approved aluminum for use in the installation of ducts for air conditioning, warm air heating, air cooling, and ventilating systems. The approval has been granted on the recommendation from the Committee on Air Conditioning of The National Fire Protection Association. The Committee's recommendation is based on a careful study of aluminum's satisfactory performance in a large number of duct work applications.

• **STANDARDS.**—The 1948 edition of NBFU Pamphlet Number 90 includes standards for ducts constructed of aluminum (see blue Data Sheet, this issue). The standards cover installation for residences as well as for industrial buildings.

The new changes include a section which points out that aluminum, cadmium plated or zinc-coated hardware and fittings, such as nuts, bolts, clamps, sheet metal screws and rivets should be used in the fabrication and erection of aluminum duct work.

Aluminum weighs only one-third as much as galvanized metal, and has properties of bright finish and corrosion resistance which make it highly adaptable for use in ducts. The base price of aluminum is now 20% below pre-war levels, according to a Reynolds Metals release.

SMALL AIR CONDITIONER

uses ice, evaporative cooling, and fan in packaged unit for houses.

University of Texas engineers have perfected a new type ice air conditioning unit to bring relief from summer heat.

• **THREE-WAY.**—Results of a series of tests in combining ice, evaporative cooling and a fan ventilating system for cooling small 4- and 5-room houses have been published in a university bulletin.

Bureau of Engineering Research staff member James D. McFarland was director of the project, assisted by Harold A. Tankersley. The 3-in-1 unit is comparatively low in cost. It can be manufactured in quantity production for much less than $1,000.

• **PACKAGE.**—The mechanics of the machine are simple. Any competent plumber can install and service the unit. Its operating costs are comparatively low in areas where humidity conditions do not require use of ice for more than 10 to 15% of the cooling period.

The engineers said the "package unit" could be commercialized for purchase from factories and installed by ice companies. The United States Department of Commerce gave funds for the research. It was first started by Engineering Dean W. R. Woolrich, now on leave of absence.

HUMIDITY TEST APPARATUS

developed for low-temperature calibration of hygrometers controls humidity in test chamber below freezing.

A humidity test apparatus, developed and built in the Mechanical Instruments Laboratory of the National Bureau of Standards, now makes available an instrument for research, calibration, and testing of hygrometers at temperatures below freezing. The use of radiosondes for the meteorological sounding of the atmosphere, an important aid in weather forecasting, has created a marked need for information on the performance of the humidity-sensing element in the radiosonde under conditions of flight. The humidity test apparatus was developed under the sponsorship of the Bureau of Ships, Department of the Navy, to provide an instrument for the investigation of radiosonde hygrometer elements at the temperatures and air velocities encountered during a flight.

• **MIXTURE.**—The function of the humidity test apparatus is to produce air of known relative humidity at temperatures from 32F to —42F. In the new, divided-flow, low-temperature, humidity-test equipment developed by Arnold Wexler, a current of dry air is divided into two streams, one of which is maintained

One of four central systems, supplemented by 91 individual unit air conditioners in Famous-Barr Department Store, St. Louis. System engineered and units manufactured by Carrier Corporation.

Cleaning Air at Low Cost

Low original cost! High dust-catching efficiency! Low maintenance cost! These advantages are outstanding in the use of DUST-STOP* replacement-type air filters in air conditioning the Famous-Barr Department Store in St. Louis.

Shown above is one of the four central filter installations supplying clean air to duct systems. Note how the filters are loaded with dust and dirt that will never have the chance to soil valuable merchandise. Soon they will be replaced with new, clean DUST-STOPS—at low cost.

There are good reasons why DUST-STOPS are specified by heating, ventilating and air-conditioning engineers. The packs of FIBERGLAS† fibers make an exceptionally efficient filter medium. Being glass—and inorganic—the fibers have no odor, nor will they rot or decay. And they do not absorb the non-odorous, non-evaporating adhesive with which they are coated. As a result, each impinged particle of dust is quickly soaked, acting as a wick to catch still more dust—until the DUST-STOP is so heavily loaded that resistance to air flow calls for replacement.

Complete details of metal frame assemblies, enabling you to design DUST-STOP panels to meet all space and CFM requirements, are given in our folder D47-34. Write for it, today . . . Owens-Corning Fiberglas Corporation, Dept. 912, Toledo 1, Ohio.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario.

DUST STOP AIR FILTERS
—a Fiberglas product

*T. M. REG. U. S. PAT. OFF.

†FIBERGLAS is the trade-mark (Reg. U. S. Pat. Off.) for a variety of products made of or with glass fibers by Owens-Corning Fiberglas Corporation.

dry while the other is saturated with respect to ice; finally the two are recombined in exactly measured proportions.

A proportioning valve is used to divide the flow of moisture-free air in a known ratio. One part is passed through a saturator over a series of trays containing ice, until it is completely saturated. It is then mixed in a mixing chamber with the other part that has been maintained dry. The mixture is allowed to exhaust through a test chamber into the atmosphere. The saturator, mixing chamber, and test chamber are kept immersed in a constant temperature bath. The hygrometer or other device, which is being subjected to air of known and constant humidity, is inserted into the test chamber.

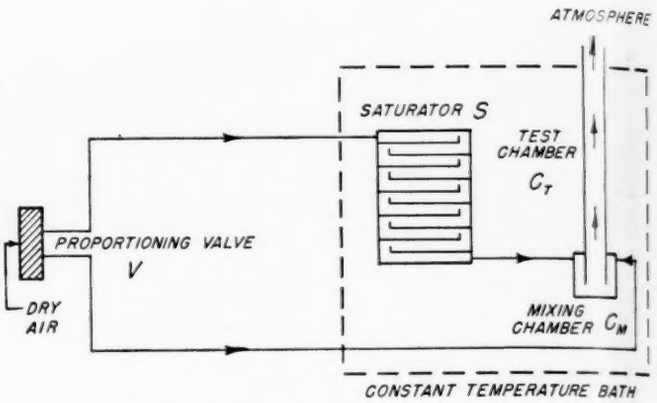
• **VARIABLES.**—The relative humidity in the test chamber is a function of (a) the fraction of air that passes through the saturator, (b) the total pressure in the saturator, (c) the total pressure in the test chamber, (d) the saturation pressure, and (e) the partial pressure of the water vapor in the test chamber. Under ideal conditions, which the apparatus closely approaches, all variables except one are eliminated, and the relative humidity is numerically equal to the fraction of air passing through the saturator.

• **SYSTEM.**—The essential functional units of the apparatus are the drying system, the proportioning system, the humidifying system, the mixing chamber, the test chamber, the cooling system, and the thermoregulating system for temperature control.

The drying system serves to remove all water from the air entering the apparatus by freezing in a dry ice-varsol bath. The dry air then passes through the proportioning system, the major feature of which is the proportioning valve. This valve, which divides the air in a definite ratio, consists of six orifices of equal cross-sectional area so arranged that by a turn of the knob of the valve the incoming air can be divided to produce any of seven ratios, 0, 1/6, 1/3, ½, 2/3, 5/6, and 1. The ratio is the fraction of air entering the valve that emerges through one channel.

The two air streams, upon leaving the proportioning system, flow through the humidifying system in parallel channels, thermally in contact with one another to allow heat interchange and temperature equilibrium between the two streams. Saturation of one stream is accomplished by allowing it to pass over a series of staggered ice-filled trays while the other stream passes over an identical path of dry shelves. The dry and saturated air are centrifugally mixed in a mixing chamber and discharged into the atmosphere through a 1⅛ in. i.d. tube that serves as a test chamber. The saturators, mixing chamber and test chamber are immersed in a bath whose temperature is closely regulated.

The over-all performance of the humidity test apparatus has been established by a series of gravimetric moisture determinations. For the temperature range of 32F to —42F and for air velocities up to 1500 fpm, this instrument produces air whose relative humidity is known within 3%.



Schematic layout of humidity proportioner.

While particularly suited for the investigation and calibration of hygrometers, psychrometers, and development apparatus at temperatures below 32F, the humidity test equipment may find further application in general research and testing where air of a known low dewpoint or moisture content is desired. With such apparatus, devices placed in the test chamber can be subjected to measurable and almost instantaneous discrete changes in relative humidity. Lag studies may therefore be easily made. The velocity of the air passing through the test chamber can be adjusted to any value up to 1500 fpm.

Although this instrument was designed primarily to fill a basic need in meteorology, the refrigeration and air conditioning industries may also find it useful. In all these fields, humidity plays an important role. With the humidity test apparatus, it is now possible to calibrate readily and accurately the various humidity measuring instruments employed at low temperatures.

• Shipments of *steel pipe and tubes* totaled 3,302,748 tons during the first six months of 1948, an increase of 10.7% over the record shipments of the first half of 1947, according to the Committee on Steel Pipe Research of the American Iron and Steel Institute.

• Total revenues from *sale of gas* by utilities amounted to about $358 million for the second quarter of 1948, a gain of 7.5% over the comparable quarter of 1947. On June 30, 1948, the gas utility industry was serving 29,900,000 customers, 4% over last year's figures, according to the American Gas Association.

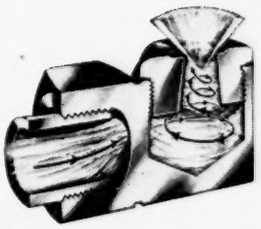
• In 1935 only three Iowa farms out of 20 were electrified. Today *16 out of 20 have electric power*, the Rural Electrification Administration reports.

• According to the U. S. Bureau of Mines, the *production of Pennsylvania anthracite* in 1947 totalled 57,190,009 net tons, a decline of 5% from the output in 1946.

Redesigned ...FOR NEW EFFICIENCY!

Binks
ROTOJET
clog-proof spray nozzles

Redesigned to embody latest post-war improvements, Binks famous Rotojet Spray Nozzles set a new high standard in spraying efficiency! Constructed on the off-center inlet, whirl chamber principle, Binks Rotojet nozzles provide fine, uniform fluid break-up and distribution at pressure as low as 7 lbs. Nozzles are precision-machined from tough, marine bronze, also stainless steel and any special alloys that are machinable from bar stock. Internal surfaces are smooth and free from vanes and other obstructions. Available in a wide variety of sizes and capacities.



Send today **for technical bulletin describing Binks ROTOJET Nozzles.**

Bulletins give full information on sizes and capacities of the following Binks Rotojet Nozzles:

Bulletin Numbers:
10. Small and Medium Capacity Nozzles
11. Nozzles for Brine Spray Operation
12. Large Capacity Nozzles
13. Nozzles for Spray Ponds
14. Nozzles for Metal Cleaning Operations

Please state how nozzles will be used, and give capacity of installation.

THERE'S A BINKS SPRAY NOZZLE FOR EVERY SPRAY JOB

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REPRESENTATIVES IN ALL PRINCIPAL CITIES ■ 3120-38 CARROLL AVENUE, CHICAGO, ILL.

KRITZER RADIANT COILS

Illustration shows workman soldering connections on coil run. Coils are suspended in soldering position and then moved up into installed position immediately below joists.

KRITZER RADIANT COILS, INC., has developed a radiant coil for circulating hot water systems that has revolutionized the field of radiant heating. Interest in this phase of heating has risen tremendously within recent years, and has set in motion a new trend toward radiant heat which has made this one of, if not the most popular subject in news of the building trade. These finned coils are an adaptation of the finned coil principle which has been used in the refrigeration industry for many years with great success. Constructed entirely of non-ferrous metals, copper and aluminum, they are light in weight and will last the life of the structure. The low original cost and simplicity of installation make Kritzer Radiant Coils the most desirable form of radiant heat on the market today.

See for yourself how Kritzer Radiant Coils will enable you to complete jobs faster. Additional information is available . . . write us today.

"IF IT'S KRITZER, IT'S RIGHT, SIR!"

KRITZER RADIANT COILS, INC.
2901 Lawrence Avenue, Chicago 25, Ill.

DEGREE-DAYS FOR SEPTEMBER, 1948

HEATING AND VENTILATING's 22nd Year of Publication of Monthly Degree-Day Data

City	September			Cumulative, Sept. 1 to Sept. 30			Heating Season[1]
	1948	1947	Normal	1948	1947	Normal	Normal
Abilene, Texas	10	0	0	10	0	0	2061
Albany, New York	136	185	72	136	185	72	6580
Albuquerque, New Mexico	80	0	0	80	0	0	4298
Alpena, Michigan	130	234	222	130	234	222	8299*
Anaconda, Montana	316	355	335	316	355	335	8357**
Asheville, North Carolina	47	80	0	47	80	0	4232
Atlanta, Georgia	7	22	0	7	22	0	2890
Atlantic City, New Jersey	40	87	0	40	87	0	5176
Augusta, Georgia	4	22	0	4	22	0	2161
Baker, Oregon	275	224	258	275	224	258	7163
Baltimore, Maryland	24	87	0	24	87	0	4533
Billings, Montana	124	214	189	124	214	189	7119
Binghamton, New York	(a)	160	108	(a)	160	108	6808
Birmingham, Alabama	4	8	0	4	8	0	2352
Bismarck, North Dakota	99	275	222	99	275	222	9192
Block Island, Rhode Island	63	115	0	63	115	0	5788
Boise, Idaho	155	136	102	155	136	102	5552
Boston, Massachusetts	76	137	48	76	137	48	6045
Bozeman, Montana	228	327	336	228	327	336	8521**
Buffalo, New York	93	168	75	93	168	75	6822
Burlington, Vermont	163	206	144	163	206	144	7514
Butte, Montana	338	381	344	338	381	344	8235**
Cairo, Illinois	15	43	0	15	43	0	3909
Canton, New York	174	242	189	174	242	189	8020
Charles City, Iowa	81	171	93	81	171	93	7588
Charleston, South Carolina	0	4	0	0	4	0	1769
Charlotte, North Carolina	18	53	0	18	53	0	3120
Chattanooga, Tennessee	3	23	0	3	23	0	3118
Cheyenne, Wyoming	143	175	240	143	175	240	7466
Chicago, Illinois	19	107	76	19	107	76	6077
Cincinnati, Ohio	26	84	0	26	84	0	4684
Cleveland, Ohio	75	127	27	75	127	27	6155
Columbia, Missouri	31	50	0	31	50	0	4922
Columbia, South Carolina	7	32	0	7	32	0	2364
Columbus, Ohio	45	112	0	45	112	0	5398
Concord, New Hampshire	184	236	168	184	236	168	7353
Concordia, Kansas	33	49	0	33	49	0	5315
Dallas, Texas	2	0	0	2	0	0	2256
Davenport, Iowa	42	105	0	42	105	0	6289
Dayton, Ohio	55	131	0	55	131	0	5264
Deer Lodge, Montana	386	357	399	386	357	399	8672**
Denver, Colorado	37	73	72	37	73	72	5874
Des Moines, Iowa	36	103	0	36	103	0	6384
Detroit, Michigan	74	150	42	74	150	42	6490
Devils Lake, North Dakota	118	339	276	118	339	276	9970
Dodge City, Kansas	34	19	0	34	19	0	5035
Dubuque, Iowa	57	142	36	57	142	36	6790
Duluth, Minnesota	137	336	270	137	336	270	9483
Eastport, Maine	272	239	276	272	239	276	8520**
Elkins, West Virginia	129	161	63	129	161	63	5697
El Paso, Texas	2	0	0	2	0	0	2428
Ely, Nevada	247	220	(a)	247	220	(a)	(a)
Erie, Pennsylvania	67	118	36	67	118	36	6273
Escanaba, Michigan	123	233	243	123	233	243	8771
Evansville, Indiana	22	81	0	22	81	0	4244
Fort Smith, Arkansas	10	5	0	10	5	0	3147
Fort Wayne, Indiana	67	154	0	67	154	0	5925
Fort Worth, Texas	1	0	0	1	0	0	2148
Fresno, California	18	2	0	18	2	0	2334
Galveston, Texas	0	0	0	0	0	0	1016
Grand Junction, Colorado	18	27	0	18	27	0	5548
Grand Rapids, Michigan	55	161	57	55	161	57	6535
Green Bay, Wisconsin	124	205	132	124	205	132	7825
Greensboro, North Carolina	28	72	0	28	72	0	3529
Greenville, South Carolina	19	42	0	19	42	0	3380
Harrisburg, Pennsylvania	71	125	0	71	125	0	5375
Hartford, Connecticut	90	158	48	90	158	48	6036
Hatteras, North Carolina	0	2	0	0	2	0	2571
Havre, Montana	177	286	270	177	286	270	8700
Helena, Montana	255	283	251	255	283	251	7894**
Houston, Texas	0	0	0	0	0	0	1157
Huron, South Dakota	79	182	123	79	182	123	8004
Indianapolis, Indiana	52	106	0	52	106	0	5298
Jackson, Mississippi	12	3	(a)	12	3	(a)	(a)
Kansas City, Missouri	13	41	0	13	41	0	4956
Knoxville, Tennessee	12	38	0	12	38	0	3670
La Crosse, Wisconsin	98	199	96	98	199	96	7322
Lander, Wyoming	136	180	276	136	180	276	7947
Lansing, Michigan	98	199	114	98	199	114	7048

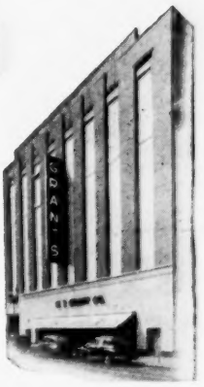
(a)—Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Sioux City, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; and Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 114]

W. T. Grant Co.'s Largest Store Heated by Smith-Mills Boilers



MODERN EXTERIOR INVITES SALES
New W. T. Grant Co. Store in Syracuse, New York. Completely modern in every detail, to help customers *buy*, salespeople *sell*. Architect — P. A. Cunnius; Mech. Eng'rs. — Jaros, Baum & Bolles; Heat. Cont. — Edward Joy Co.

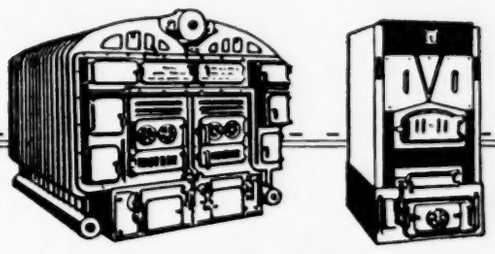
The W. T. Grant Co. chain sells millions of dollars worth of goods in an average postwar year! It isn't all gravy, however — overhead costs really eat into profits in these days of high break-even points!

But Grant management knows that *some* operating costs — like heating —can be cut to the bone . . . by selecting equipment that costs less to operate and maintain. That's why over 200 Grant stores have installed Smith-Mills *cast-iron* boilers. As a result, they're enjoying lower fuel bills, negligible maintenance costs— and better heating, to boot!

Equally important, Smith-Mills installations leave Grant greater basement area for storing, displaying or selling merchandise—because a Smith-Mills installation *takes* less space. Smith-Mills boilers are constructed of cast iron, don't need large open working space in front of the boiler for replacement of tubes.

It *always* makes sense to specify Smith-Mills for commercial, institutional, and industrial installations. And when profits hinge on lowered operating and maintenance costs, it makes *double sense.*

EFFICIENT HEATING ENCOURAGES PROFITS
Boiler room of the new Grant Syracuse Store, heated by two 24 section No. 60 Smith-Mills boilers, which *fired* by gas, deliver a total of 12,000,000 b.t.u.'s per hour.



H. B. Smith

CAST-IRON BOILERS

THE H. B. SMITH CO., INC., 63 Main Street, Westfield, Mass. • OFFICES AND REPRESENTATIVES IN PRINCIPAL CITIES

Degree-Days for September, 1948 (Concluded)

HEATING AND VENTILATING's 22nd Year of Publication of Monthly Degree-Day Data

City	September			Cumulative, Sept. 1 to Sept. 30			Heating Season[1]
	1948	1947	Normal	1948	1947	Normal	Normal
Lewiston, Maine	120	219	165	120	219	165	7707
Lincoln, Nebraska	42	84	0	42	84	0	5999
Little Rock, Arkansas	10	11	0	10	11	0	2811
Livingston, Montana	175	301	227	175	301	227	7245**
Los Angeles, California	4	1	0	4	1	0	1504
Louisville, Kentucky	24	61	0	24	61	0	4180
Lynchburg, Virginia	52	99	0	52	99	0	3980
Macon, Georgia	3	19	0	3	19	0	2201
Madison, Wisconsin	104	177	87	104	177	87	7429
Marquette, Michigan	161	270	225	161	270	225	8693*
Memphis, Tennessee	16	14	0	16	14	0	2950
Meridian, Mississippi	11	9	0	11	9	0	2160
Milwaukee, Wisconsin	73	179	84	73	179	84	7245
Minneapolis, Minnesota	58	195	93	58	195	93	7850
Modena, Utah	89	138	156	89	138	156	6562
Montgomery, Alabama	3	4	0	3	4	0	1884
Nantucket, Massachusetts	112	139	63	112	139	63	5957
Nashville, Tennessee	20	27	0	20	27	0	3507
New Haven, Connecticut	71	142	39	71	142	39	5895
New Orleans, Louisiana	89	0	0	89	0	0	1024
New York, New York	20	105	50	20	105	50	5274***
Nome, Alaska	Degree-Days for June, 1948 (not previously published) are 569. Total for season (Sept. 1, 1947 to June 30, 1948) is 13,646.						
Norfolk, Virginia	1	30	0	1	30	0	3350
North Head, Washington	222	220	255	222	220	255	5452**
North Platte, Nebraska	60	113	42	60	113	42	6366
Oakland, California	107	78	90	107	78	90	3143**
Oklahoma City, Oklahoma	6	0	0	6	0	0	3613
Omaha, Nebraska	36	88	0	36	88	0	6131
Oswego, New York	118	167	114	118	167	114	7088
Parkersburg, West Virginia	50	110	3	50	110	3	4775
Peoria, Illinois	39	109	3	39	109	3	6109
Philadelphia, Pennsylvania	21	95	36	21	95	36	4737***
Phoenix, Arizona	0	0	0	0	0	0	1405
Pittsburgh, Pennsylvania	60	131	0	60	131	0	5235
Pocatello, Idaho	165	181	156	165	181	156	6655
Portland, Maine	160	223	162	160	223	162	7218
Portland, Oregon	121	67	105	121	67	105	4469
Providence, Rhode Island	68	133	63	68	133	63	6015
Pueblo, Colorado	41	49	6	41	49	6	5514
Raleigh, North Carolina	14	57	0	14	57	0	3234
Rapid City, South Dakota	76	164	144	76	164	144	7118
Reading, Pennsylvania	50	119	0	50	119	0	5389
Red Bluff, California	19	6	(a)	19	6	(a)	(a)
Reno, Nevada	163	136	144	163	136	144	5892
Richmond, Virginia	28	77	0	28	77	0	3695
Rochester, New York	114	173	72	114	173	72	6732
Roseburg, Oregon	135	97	111	135	97	111	4428
Roswell, New Mexico	30	3	0	30	3	0	3484
Sacramento, California	28	8	0	28	8	0	2653
St. Joseph, Missouri	24	55	0	24	55	0	5161
St. Louis, Missouri	16	56	0	16	56	0	4585
Salt Lake City, Utah	86	110	18	86	110	18	5555
San Antonio, Texas	0	0	0	0	0	0	1202
San Diego, California	6	0	0	6	0	0	1645
Sandusky, Ohio	44	114	0	44	114	0	6208
San Francisco, California	154	136	114	154	136	114	3264**
Sault Ste. Marie, Michigan	193	310	276	193	310	276	9285**
Savannah, Georgia	0	5	0	0	5	0	1490
Scranton, Pennsylvania	99	162	60	99	162	60	6129
Seattle, Washington	180	127	186	180	127	186	4934**
Sheridan, Wyoming	133	200	264	133	200	264	8008
Shreveport, Louisiana	0	2	0	0	2	0	1938
Sioux City, Iowa	49	142	33	49	142	33	6898
Spokane, Washington	236	200	192	236	200	192	6355
Springfield, Illinois	27	80	0	27	80	0	5373
Springfield, Missouri	42	44	0	42	44	0	4428
Syracuse, New York	135	182	96	135	182	96	6893
Tacoma, Washington	230	166	207	230	166	207	5181**
Terre Haute, Indiana	42	114	0	42	114	0	4872
Toledo, Ohio	75	156	9	75	156	9	6077
Topeka, Kansas	20	39	0	20	39	0	4969
Trenton, New Jersey	46	120	0	46	120	0	4933
Utica, New York	91	172	182	91	172	182	6796
Valentine, Nebraska	73	140	93	73	140	93	7039
Walla Walla, Washington	131	68	20	131	68	30	4808
Washington, D. C.	27	87	0	27	87	0	4626
Wichita, Kansas	19	17	0	19	17	0	4673
Williston, North Dakota	121	316	270	121	316	270	9323
Winnemucca, Nevada	153	151	192	153	151	192	6427**
Yakima, Washington	191	116	120	191	116	120	5599

(a) Data not available.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Know Your Pressure, Vacuum and Differential Readings

DWYER FLEX-TUBE MANOMETERS

FOR

- Velocity and static pressures
- Leakage, fan and blower tests
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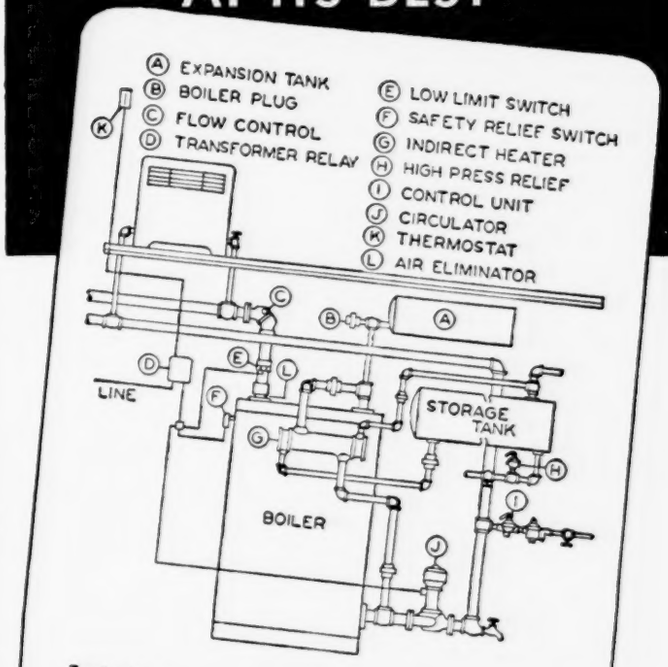
PICTURE OF

HOT WATER HEATING AT ITS BEST



Typical installation diagram of Triplex flow controlled, two-pipe up-feed hot water heating system with indirect domestic hot water.

Ease of Installation and Dependable Operation Make *Triplex* FIRST CHOICE

Direct Drive Circulators

Flow Control Valves

One-Pipe Distributors

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If you really want to profit from the rapidly growing demand for hot water heating, sell Triplex Flow Control Systems, too. The same Triplex units that assure *hot water at its best* in homes can also be applied to large installations by merely increasing the number or size of individual operating units. Hot water is automatically circulated—abundant heat supplied the radiators instantly, whenever and wherever needed. Thanks to complete standardization, advanced design and precision construction of all Triplex products, installations can be made quickly and easily. Best of all, operation is so trouble-free and dependable that service calls are few and far between. Yes, *Triplex means hot water at its best* . . . for everyone concerned. Push it for conversions as well as new installations. You'll win both ways. Write today for latest catalog.

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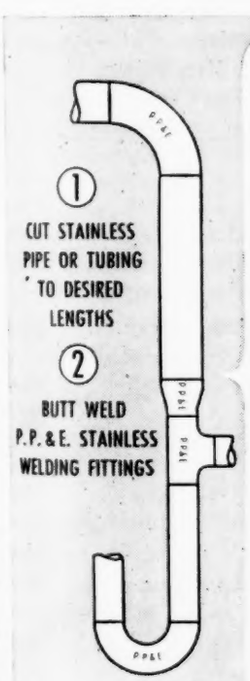

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NEW CATALOGS

Pumps

Bulletin No. 101 describes Roth heavy duty flexible coupled pumps, special metal pumps, and a series of industrial pumps. Catalog data, specifications, selection tables, and prices are included.—*Roy E. Roth Co., Rock Island, Ill.* 193

Propeller Fans

Self cooled motor propeller fans are featured in a catalog No. 148. Three types of fans are shown ranging from smallest to largest sizes.—*Ilg Electric Ventilating Company, 2858 N. Crawford Ave., Chicago 41, Ill.* 194

Fractional Horsepower Motors

Redmond Micromotors are described in a new catalog. In size, units range from 1/500th hp up to 1/15 hp. They are made in both open-ventilated and totally-enclosed models and in steel and cast cases.—*Redmond Company, Inc., Owasso, Mich.* 195

Direct-Fired Heater

The Thermobloc packaged direct-fired unit heaters for space heating is described in an 8-page, 2-color bulletin. Unit is said to operate at 80 to 85% efficiency with No. 3 fuel oil or gas delivering 550,000 Btu per hour.—*Thermobloc Div., Prat-Daniel Corp., East Port Chester, Conn.* 196

Floor Furnaces and Water Heaters

Coleman automatic floor furnace and water heaters for gas, L.P. gas, or oil are described in a 12-page bulletin.—*The Coleman Company, Inc., Wichita 1, Kan.* 197

Water Treatment Valve

The hydromatic single control valve, now standard equipment on Cochrane zeolite softeners and pressure filters, is described in Bulletin No. 4460. Valve is said to perform normal functions of water treatment valve nest integrated and controlled by one single valve. Valve features four normal and two standby positions. —*Cochrane Corporation 17th St. and Allegheny Ave., Philadelphia 32, Pa.* 198

Reflective Insulation Data

Under the title *Simplified Physics of Thermal Insulation*, a 32-page booklet compares *k*, *C*, *R* and *U* for a number of insulators with emphasis upon Infra reflective insulation, an accordion-pleated arrangement of two layers of aluminum foil separated by an air space. Fundamentals of heat transfer are covered in the booklet, and graphs demonstrate the conduction and radiation components of heat flow under various conditions. Installation procedures for Infra insulation are included.—*Infra Insulation Inc., 10 Murray St., New York 7, N. Y.* 199

Instrumentation System

Engineering and application data covering the new ATC instrumentation system "Atcotran" features pressure measurements electrically transmitted with accuracies within ¼ of 1% of reading on indicator or recorder type instruments. Sketches illustrate applications to measurements of density, flow, weight, pressure, humidity, temperature, etc. — *Automatic Temperature Control Co., Inc., 5212 Pulaski Ave., Philadelphia 44, Pa.* 200

Refrigeration Manual

A 40-page manual consists of a concise elementary text to aid servicemen, salesmen, students or anyone interested in refrigeration and a better understanding of the basic factors. It covers fundamentals of all phases of refrigeration without reference to particular types or makes of equipment.—*Copeland Refrigeration Corp., Sidney, Ohio.* 201

Radiation Elements

A cast aluminum, diagonally finned, radiation element is described in Bulletin No. 40. Other elements in both cast iron and aluminum are included as well as de-icing and drying machines both of which utilize Wilson radiation elements for heat transfer.—*Wilson Engineering Corp., 122 S. Michigan Ave., Chicago 3, Ill.* 202

Tachometers

Bulletin No. 104 describes new, low cost, electric tachometers for all installations. Several tachometer heads are shown for industrial, marine, railway, diesel and aircraft applications and for direct head coupling from 1 rpm to 100,000 rpm.—*Metron Instrument Co., 432 Lincoln St., Denver 9, Colo.* 203

Dust and Fume Control

Two new catalogs, Nos. 480 and 481, describe spray booths, dust and fume control units, mechanical washers, industrial ovens, and sheet metal equipment with photographs and blueprint reproductions of typical installations. Tables of technical information are included.—*Schmieg Industries, Inc., 370 Piquette Ave., Detroit 2, Mich.* 204

Vibration Control Data

Factors of spring mountings, rubber mountings and cork materials in the control of vibration together with data on installation and listings are given in a new bulletin, G-101. A selector chart is included.—*The Korfund Company, 48-01-E Thirty-second Place, Long Island City 1, N. Y.* 205

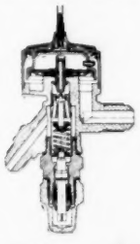
Induction Motors

Two bulletins describe heavy duty, squirrel cage, induction motors. Cut-away and sectional drawings show details of welded frame construction, bearings and insulation. Tables of sizes and application data are included.—*Electric Machinery Mfg. Co., Minneapolis 13, Minn.* 206

When You Need a Pressure Limiting Valve...

Valuable addition to the already-complete line of A-P Thermostatic Expansion Valves, the new Model 212 provides welcome "performance insurance" on any system where motor overload may be indicated. It offers advantages never before achieved in a pressure limiting thermostatic expansion valve.

You may install the A-P Model 212 in place of any standard thermostatic expansion valve of similar capacity (½ and 1 ton Freon or Methyl). Like all A-P expansion valves, it is liquid charged and may be mounted in any position or ambient temperature without affecting the control-accuracy at the bulb. Operating suction pressure is limited to a predetermined setting by an exclusive and entirely new diaphragm unit. This diaphragm actuates the needle pin, allowing the valve needle to move towards the closed position, until the overload condition has passed. Then the valve operates in the normal manner to control superheat through the thermostatic bulb and sensitive large-area diaphragm.



Cross section . . . showing new pressure limiting diaphragm unit.

Model 212 is available to limit pressures at 15, 40, and 55 lbs. Freon 12, and at 10 and 30 lbs. Methyl. Capacity, ½ and 1 ton Freon or Methyl. Model 211 with fixed superheat, same capacity, is also available.

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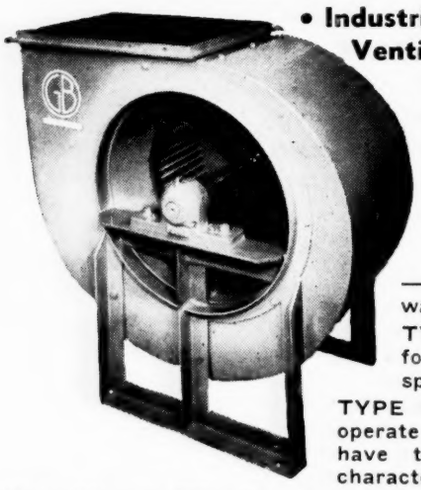
- Induced Draft
- Forced Draft
- Air-conditioning
- Drying and Processing



—are of forward or backward curved wheel design.

TYPE F. C. are designed for quiet operation at low speeds.

TYPE B. C. are designed to operate at high speeds and have the non-overloading characteristics.

Capacities of 200 c.f.m. to 300,000 c.f.m. are covered by standard sizes and arrangements.

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Fans

Three new catalogs describe industrial fans. A 24-page catalog on axial flow vent sets No. DV-2-48 covers both volume and pressure fans from 16 to 48 in. in diameter. Power flow roof ventilators are described in catalog DP3-48. Catalog DV-4-48 describes the DeBothezat bifurcator, a fan wheel mounting in a patented split housing for exhausting corrosive or explosive fumes.—*DeBothezat Fans Div., American Machine and Metals, Inc., East Moline, Ill.* 207

Welding Branch Pipe Outlets

A 24-page catalog illustrates Bonney WeldOlets for branch pipe outlets. Three types of outlets include butt welding, thread and socket welding. Outlets are inserted into pipe walls for side outlets. — *Bonney Forge & Tool Works, Allentown, Pa.* 208

Scotch Boilers

Twelve sizes of Scotch boilers ranging in capacity from 10 to 180 hp, 1400 to 25,500 sq ft of radiation, are covered in a new bulletin. Boilers can be used for power, heating, and processing.—*The Brownell Company, 410 N. Findlay St., Dayton 1, Ohio.* 209

Pipe and Fittings

An illustrated booklet covering Karbate brand pipe and fittings contains engineering information and tables of chemical and physical properties of the material.—*National Carbon Co., Inc., 60 E. 42nd St., New York 17, N. Y.* 210

Ventilating Equipment

Roof fans, turbine ventilators, exhaust fans and stationary ventilators are described and illustrated in an 8-page catalog, No. 431, with tables of capacities and dimensions. Special protective coatings are available. A list of nationwide sales representatives is included.—*Allen Ventilator Div., Production Planning Co., Rochester, Mich.* 211

NOVEMBER, 1948

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Editor, HEATING AND VENTILATING,
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193	194	195	196	197
198	199	200	201	202
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208	209	210	211	

Name.....

Title (Must be shown).....

Firm (Must be shown).....

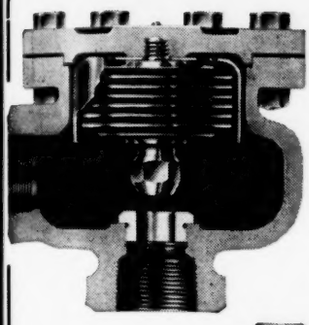
Business Address.....

City.....Zone....State..... 11/48

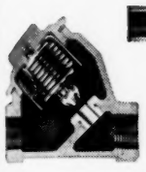
We Invite You

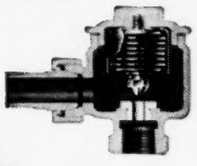
TO TEST NICHOLSON STEAM TRAPS FOR

LOWEST STEAM LOSS
LARGEST CAPACITY



See why an increasing number of America's leading plants are standardizing on Nicholson traps.





Comparative tests by large trap users show: record low for steam waste; 2 to 6 times average drainage capacity; operate on lowest temperature differential; no freeze-ups; greater simplicity (fewer spare parts). 5 types for every purpose; size ¼" to 2"; pressures to 225 lbs. Test trap gladly sent. BULLETIN 1047.

W. H. NICHOLSON & CO. 199 OREGON STREET WILKES-BARRE, PA.

Valves • Traps • Steam Specialties

Solenoid

STAINLESS STEEL

Valves

ACTUAL SIZE

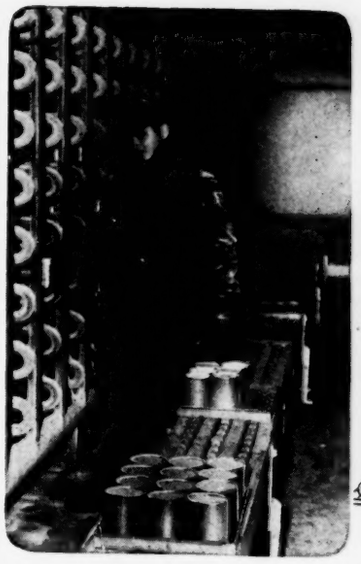
★ Standard pressure range, 5 to 250 psi
★ Dimensions 2¾" high x 1⅝" dia.
★ Impregnated coils withstand moisture and condensation
★ Soft insert seats prevent leakage
★ Spring loaded for positive action
★ Stainless steel parts highly resistant to corrosion and wear
★ Power consumption 10 watts max.
★ Pipe connections to specification
★ Also many special valves for handling pressures from 5 to 850 psi

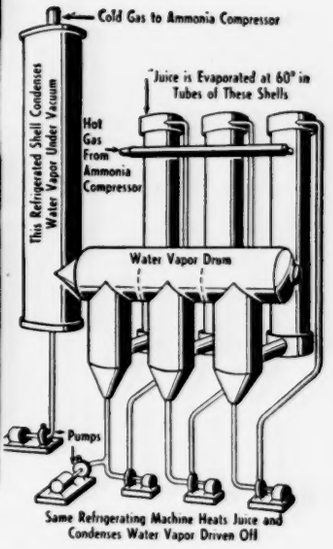
THREE WAY - TWO POSITION
TWO WAY - NORMALLY CLOSED
TWO WAY - NORMALLY OPEN

Skinner will be pleased to make recommendations on your particular design applications — they have for hundreds of others. Write today for details and catalog.

SKINNER ELECTRIC VALVES

Skinner ELECTRIC VALVE DIV.
THE SKINNER CHUCK COMPANY
136 Belden Ave., Norwalk, Conn.




Cold Gas to Ammonia Compressor
Juice is Evaporated at 60° in Tubes of These Shells
This Refrigerated Shell Condenses Water Vapor Under Vacuum
Hot Gas From Ammonia Compressor
Water Vapor Drum
Pumps
Same Refrigerating Machine Heats Juice and Condenses Water Vapor Driven Off

New Process Uses

FRICK Refrigeration

for both Boiling and Freezing Orange Juice!

The plant of the Florida Citrus Canners Cooperative, at Lake Wales, is remarkable because it uses refrigeration instead of steam for concentrating fruit juices.

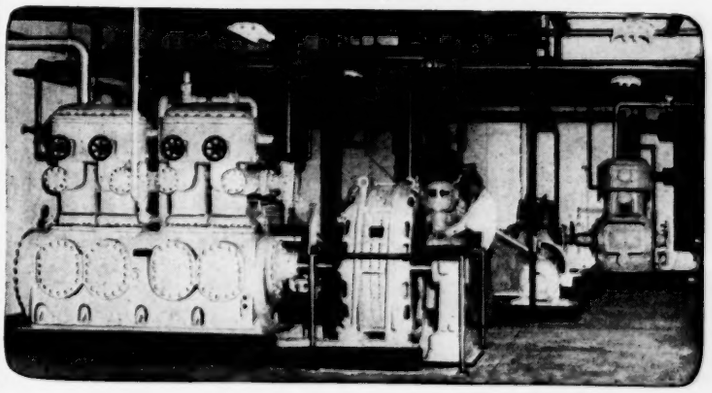
The cycle shown, on which Mojonnier Bros. Co. of Chicago have patent applications, utilizes both the heat and the cold supplied by a refrigerating machine — and with excellent economy. This principle can be applied equally well to concentrating milk, various fruit and vegetable juices, pharmaceuticals, liquid eggs, pectin and sucrose solutions, chemicals, etc. As the condensate is completely recovered, the process can also be used for distillation work.

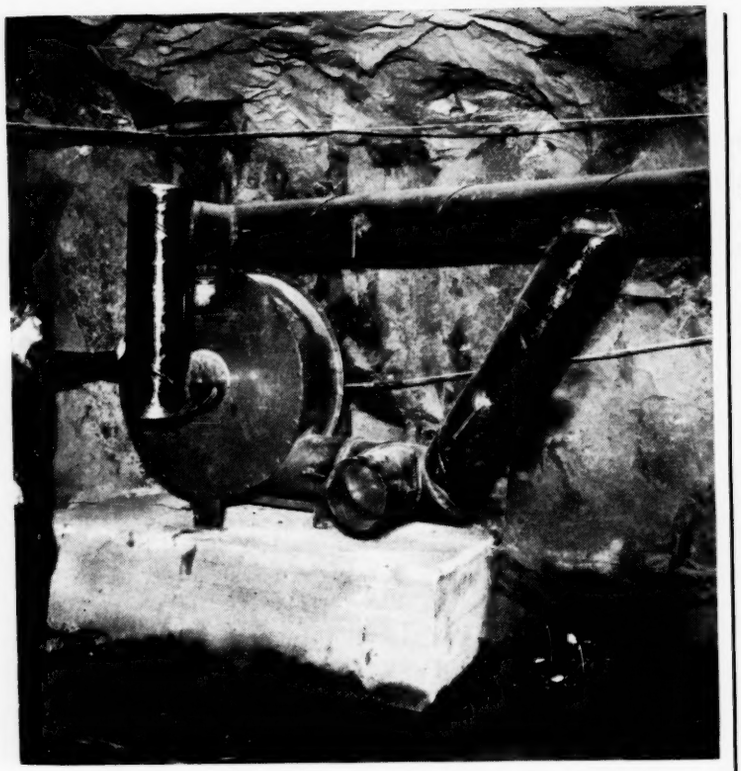
At Lake Wales, a separate Frick refrigerating system quick-freezes and stores the concentrated and vacuum-packed juices at ten below zero. Food value and fresh flavor are both retained. Additional Frick machinery to enlarge the plant has recently been purchased.

Let us cooperate in solving YOUR particular refrigerating problems.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

4 of 5 Frick Ammonia Compressors, Lake Wales

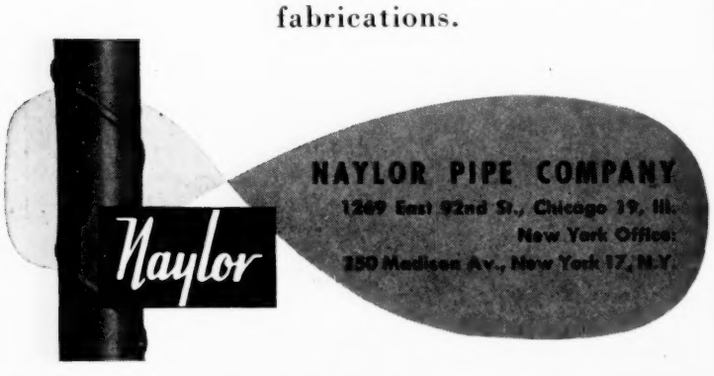




It's NAYLOR PIPE...

The Stand-by for Ventilating Lines

Naylor lightweight pipe and Naylor Wedge-Lock couplings provide the ideal combination for push-pull ventilating, exhaust lines and other high and low pressure air service. The light weight of Naylor Pipe and the faster, easier connections through the Wedge-Lock couplings simplify handling and installation and save money all along the line. Sizes from 4 to 30 inches in diameter with all types of fittings, connections and fabrications.



WHAT READERS SAY

Outside Temperature Control

EDITOR, HEATING AND VENTILATING:

I have read Mr. Canar's article on Page 65 of your September issue.

Mr. Canar's article advocates increasing necessary radiation by twenty to twenty-five percent above actual needs in order to compensate for what is obviously a deficiency in the control system.

It seems to me that any such remedy would amount to a twenty-year step backwards in the heating business. It was just about twenty years ago that Mr. F. I. Raymond undertook to solve this problem, and he did it very effectively with his Duostat control. To the best of my knowledge that was the first successful outside temperature control, and it anticipated the lag and overrun in the ordinary heating system so as to maintain a uniform temperature within a home or building with intermittent operation.

This Duostat method of heat regulation was completely described by Mr. Raymond at the Thirty-sixth Annual Meeting of the American Society of Heating and Ventilating Engineers in Philadelphia in January 1930, and it was advertised in the May and November issues in 1931 of your magazine.

There are many homes and many buildings that are today being controlled by that device and successfully overcoming the objectionable features that Mr. Canar refers to. I am sure that method of control will solve this problem much more satisfactorily and at a much lower cost than increasing the radiation that now occupies more floor space than most people are willing to allocate to it.

Robert L. Fitzgerald
The Duluth Steam Corporation

Duluth, Minn.

Getting Personal

E. J. Ackerman

Edward J. Ackerman *(Design Features of Centrifugal Pumps,* page 60) was graduated from Newark College of Engineering in 1922. His first engagement was with the o'd Edison Lamp Works of the General Electric Co., Harrison, N. J., in the Plant Engineering Depa~tment where he received his first power plant experience.

Between 1926 and 1929 he divided his time with the Thomas E. Murray, Inc., organization as a piping engineer, and as mechanical engineer with the Universal Sheet Metal Works in New York City. During this latter engagement he supervised the installation of ventilating and air conditioning equipment and designed the duct layouts for several well-known theatres in New York.

In 1929 he joined the Engineering Department of the

United Electric Light and Power Co. which was subsequently merged into the present Consolidated Edison Co. During this period the company advanced progressively from stokers to pulverized fuel fired boilers to huge high pressure topping turbine installations. Mr. Ackerman, as Assistant Engineer in the Turbine Plant Division of the Mechanical Engineering Department, handled many important phases of these projects, including the usual types of pumping applications and most of the high pressure boiler feed pumps for the topping installations.

From 1942 to 1944 Mr. Ackerman was with the M. W. Kellogg Co. on a war-time leave of absence from Consolidated Edison Co., engaged in the design and construction of the power plant and chlorine liquefaction plant in connection with the huge magnesium project erected at Lake Charles, La., spending seven months of this period on the job as resident engineer.

In 1944 he was recalled by Consolidated Edison.

C. G. Segeler

C. George Segeler *(Gas For Heating Large Buildings*, page 67) took his degree in chemical engineering from Columbia University in 1922. After varied experience in the utility business, notably with Consolidated Edison, he joined AGA in 1925. Since that time he has been engaged with various phases of gas utilization engineering. He is the author of several AGA publications including *Combustion* and *Fuel and Flue Gases*, and has been engaged editorially in the production of many other publications issued by the American Gas Association.

. . . Since the Last Issue

Marshall G. Munce has been elected a vice president of **York Corp.** His major assignment will be that of representing top management in assisting and supporting the sales organization through trade relations and public relations activities. A graduate of the Virginia Military Institute and the Massachusetts Institute of Technology, Mr. Munce first joined the York organization in 1921. From 1932 to 1937 he was manager of the Washington sales office, following which he took an emergency assignment as managing director of the corporation's British subsidiary, York-Shipley Limited, London, England. Since returning to York in 1940, Mr. Munce has been assistant to the president, chiefly as coordinator between engineering, manufacturing, and sales divisions, which activities were recently taken over by **J. Keith Louden**, formerly with Armstrong Cork Co., of Lancaster, Pa.

Henry Valve Co., of Chicago announces the opening of a west coast office and warehouse at 736 E. Washington Blvd., Los Angeles, October 1, which will be headquarters for the Pacific Coast, Idaho, Nevada and Arizona. This office will be in charge of **Richard S. Dawson**, who will be western district manager.

The **American Welding Society** has elected **George N. Sieger** of Detroit as its president for the year 1948-49. Mr. Sieger is president of the S-M-S Corp., Detroit.

James C. Tweedell, long engaged in the international field of air conditioning and refrigeration, has joined the New York headquarters staff of the International Division of **Carrier Corp.**

We Didn't Want to Make Strainers

BUT we needed them for use with Yarway Steam Equipment and couldn't find any to suit us.

So we designed the *YARWAY Strainer.*

Apparently a lot of other people were having "Strainer trouble" because the Yarway Strainers *purchased* in a few years now number *many thousands.*

Why don't you look into this better Strainer for your money? Buy one from your supply house (nearly 150 Mill Supply Houses now have them).

Cadmium Plated for protection against corrosion and for better appearance.

Examine its *high grade Monel woven wire screen* that stops dirt —lets condensate or other fluids flow freely.

Notice the removable blow-off bushing. Screen and bushing come out together—go back together, *automatically aligning.*

Six standard sizes from ½" to 2" for pressures to 600 lb.

See your Mill Supply House or write for Bulletin S-201

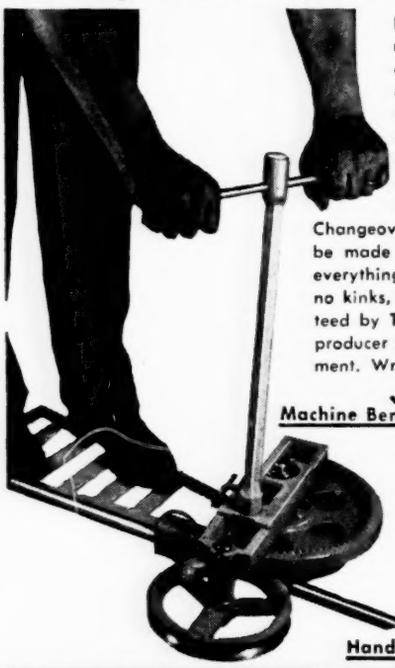
YARNALL-WARING COMPANY
104 Mermaid Ave. PHILADELPHIA 18, PA.

YARWAY STRAINERS

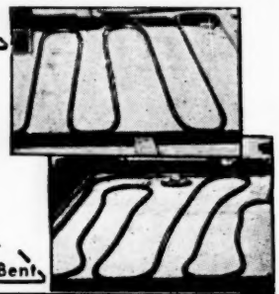
Announcing

TAL Portable Tube Bender for radiant heating

Bend right on the spot, fast and accurately



Now, with this new light-weight machine that can be carried in one hand, you can speed-up radiant heating installations . . . for the Tal Tube Bender handles, without annealing, *hard copper* tubing as well as soft, both K and L, in all diameters from 3/8" to 1" in all standard radii. Changeovers from one size to another can be made in 40 seconds. One man does everything without help. No flattening, no kinks, no wrinkles. Made and guaranteed by Tal, the world's largest exclusive producer of pipe and tube bending equipment. Write today for data bulletin.



Tal Bender, Inc. Dept. 12 Milwaukee 2, Wis.

Smoke Containers

• Used for (1) determining air currents in various air conditioning and heating applications, and (2) for detecting leaks in boilers, flues, chimneys, etc. Save time, money, "headaches." Available in yellow, black or white. Send for details, outlining your requirements. Priced as low as $3.50 per dozen.

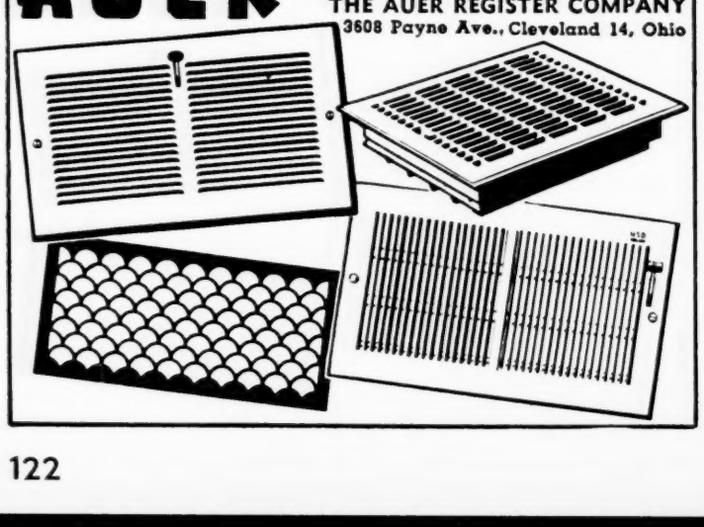
I. C. NEWMAN CO., INC.

Dept. 2, 30 E. 40th ST., NEW YORK 16, N. Y.

AUER REGISTERS & GRILLES

THE AUER REGISTER COMPANY

3608 Payne Ave., Cleveland 14, Ohio



Alfred J. Offner, consulting engineer and former president and treasurer of **ASHVE** announced his retirement from active practice on September 1, 1948. He opened his own consulting offices in 1930, and has designed the mechanical equipment for numerous government, commercial, and private buildings in the United States, Europe, South America and Asia. Mr. Offner served as president of the Society's New York Chapter, also as president of the New York Association of Consulting Engineers, and is a member of the board of governors of the New York Building Congress. He is listed in both Who's Who in Engineering and in Who's Who in America. Mr. Offner lives in 160-15 11th Ave., Beechhurst, L. I., N. Y.

Walter D. Binger was elected a director of **The National Radiator Co.,** Johnstown, Pa. Mr. Binger is vice president of the City Investing Company, and president of the City Construction Company, New York City. Mr. Binger, a graduate of Massachusetts Institute of Technology, was engaged in private practice as a consulting engineer prior to his appointment by Mayor LaGuardia as a Commissioner of the New York City Administration. During this period he was in charge of, among other municipal improvements, the design and construction of the East River Drive and Wards Island Sewage Treatment Works. Mr. Binger is chairman of the National Technological Advisory Committee, and also consultant to the Office of the Secretary of Defense.

W. D. Binger

The **Great National Air Conditioning Corp.,** of Dallas, Texas, is now a subsidiary of **United States Air Conditioning Corp.,** of Minneapolis. The entire usAIRco lines of evaporative cooling units and gas products will be merged wth those of Great National. **Don Groth,** a veteran in the sale of evaporative cooling, will serve as general sales manager of Great National with general sales offices in Oklahoma City. Great National factories are located at Dallas and Corsicana, Texas. **L. P. Hanson** continues as vice president in charge of sales of usAIRco which will concentrate on the manufacture of Refrigerated Kooleraire, store, window and console refrigerated cooling units, and its complete line of cooling, heating and ventilating equipment.

The appointment of **Al Bailey** as general manager of **Kieley & Mueller,** manufacturer of automatic control valves, has been announced. Mr. Bailey was for 10 years with King & Shepherd, New York, where he handled the Fisher Governor Co. account. He later was affiliated with W. Malcolm Black & Co. when this concern succeeded King & Shepherd.

The **Fitzgibbons Boiler Co., Inc.,** of New York announces the appointment of the **Fintube Products Co.,** 228 LaSalle Street, Chicago, Ill., as sales and service representatives in that area, according to Paul K. Addams, president of Fitzgibbons. The Fintube Products Co. will handle the entire Fitzgibbons line of steel heating and power boilers and winter air conditioners.

Research Products Corp., of Madison, Wisconsin, manufacturers of air filters, water treating minerals and related products, announces the election of **R. E. Onstad** as president of the company. Mr. Onstad succeeds Kemper Slidell, who will retain his connection with RPC as a member of the board of directors. Also announced by RPC is the employment of **John D. Wachman, Jr.,** as Chicago representative to handle the company's distribution in Illinois and Indiana.

E. J. Campbell, sales representative for **Wolverine Tube Division** (Detroit) with headquarters in Grand Rapids, has been promoted to assistant manager of mid-western sales. Mr. Campbell will headquarter in the company's Chicago office and assist in the supervision of sales throughout nine mid-western states. **S. C. Seekell,** formerly sales manager for the Westinghouse Electric Supply Co., has been appointed to succeed Mr. Campbell as sales representative. Mr. Seekell will headquarter in Grand Rapids and handle sales for Wolverine in western and southwestern Michigan.

The promotion of **P. M. Pottetti** to the position of sales manager has been announced by the **Cyclotherm Corp.,** New York City, manufacturers of steam and hot water generators. Mr. Pottetti has served as assistant sales manager of Cyclotherm for several years. Announcement was made of the promotion of Guy B. Smith to assistant sales manager in charge of advertising and sales promotion.

W. A. Siegfried, president of the Superior Valve and Fittings Co. of Pittsburgh, Pa., has been elected to the position of secretary of the **Refrigeration Equipment Manufacturers Association.** He will fill the unexpired term of G. M. Kingsland.

The **Westinghouse Electric Corp.,** has announced its decision to purchase the 57-acre Sunnyvale, Calif., plant which was leased 19 months ago from the Joshua Hendy Iron Works. Westinghouse assumed operation of the plant as of March 1, 1947, under terms of a 10-year lease with the option to purchase by Nov. 1, 1948. The plant is already in production on distribution and power transformers, alternating-current motors, steam turbines up to 12,500 kilowatts generating capacity, voltage regulators, valves, large air moving equipment, gears, switchgear, and other products.

M. J. Boho has been elected vice president in charge of sales, **Hagan Corp.,** Pittsburgh combustion control and flow meter manufacturer. Mr. Boho joined Hagan as a field service engineer in 1936, after serving as a research engineer in private industry and with the Potomac Electric Power Company, Washington, D. C. In 1938 he was transferred to Hagan's New Projects Division, where he was engaged in the development, design and application of automatic combustion controls for steel industry use. In 1945 he was appointed assistant general manager of sales. He is particularly well known in the steel industry for his engineering work in the field of automatic control of soaking pits. Mr. Boho is the author of a number of technical papers on combustion control and related subjects. He is a registered professional engineer in Pennsylvania and a member of various technical societies.

M. J. Boho

Tuttle & Bailey, Inc., New Britain, Conn., has announced the appointment of **Robert S. Rickabaugh** as assistant sales manager. Associated with Tuttle & Bailey since January, 1946, Mr. Rickabaugh has served as eastern zone manager. Following graduation from the United States Naval Academy in 1927, Mr. Rickabaugh was a member of the heating, ventilating and air conditioning staff of the Pennsylvania-Edison Company for 14 years. At the outset of World War II he was commissioned into the Navy and during his 4½ years of service saw duty in the Pacific and Mediterranean Theatres. At the end of hositilities, he held the rank of Commander. In his new capacity at Tuttle & Bailey, Mr. Rickabaugh will make his headquarters at the home office in New Britain and will assist in the sales work of all products including convectors, air conditioning grilles, registers and ceiling diffusers.

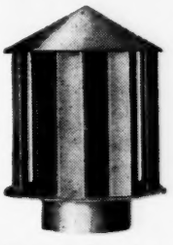
ON CHIMNEYS AND VENT FLUES

Breidert Air-X-Hausters

(PAT. NO. 2269428)

Breidert Air-X-Hauster Chimney Top makes fireplace draw better.

the first scientific improvement in roof ventilators in over 50 years!



Type B Breidert Air-X-Hauster for factories, commercial and residential buildings.

No matter which way the wind blows, no matter how bad the weather—the Breidert *provides positive exhaust.* Designed in accordance with the science of aerodynamics, this revolutionary ventilator utilizes the power of air currents coming from *all angles* to provide safe, positive ventilation without back-draft. Stationary—no moving parts to regulate or get out of order... no power consumption... compact and pleasing in appearance.

Breidert Air-X-Hauster—the first ventilator to be tested under all variable vertical and horizontal wind conditions . . . with certified ratings published.

Unlike most conventional ventilators which work efficiently only when wind strikes in a horizontal plane, the Breidert has been thoroughly tested—by U. S. Navy and Smith Emery Commercial Testing Laboratories—with the wind blowing in *all* directions. Its remarkably high performance ratings under all conditions are *certified and published.*

Many Thousands in Use all over the Country

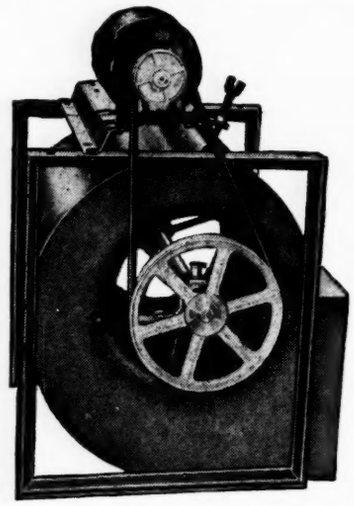
Breidert Air-X-Hausters have found wide acceptance among architects, engineers, industrialists, farmers, home owners, ship and boat owners, U. S. Army, U. S. Navy, Maritime Commission, schools, institutions and public buildings. In every case when properly installed, the Breidert has never failed to fully meet every claim made for it!

Free Engineering Data Book, with complete specifications, sent on request. Address

"Ask to see this interesting demonstration"

G. C. BREIDERT CO.,
3129 SAN FERNANDO ROAD
LOS ANGELES 41, CALIFORNIA

Representatives in 50 principal cities throughout the United States



THE

NEW

UNIVERSAL

TYPE "N"

BLOWER

MASSACHUSETTS . .

By changing the position of the oil cup, the four popular discharges (lower horizontal, upper horizontal, down-blast and up-blast) can be obtained. Sizes 7 to 16½ inches wheel diameter.

WRITE FOR BULLETIN No. 110 CATALOG

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

4901 HAMILTON AVENUE · CLEVELAND 14, OHIO

HOW TO GET RID OF

EXHAUST GAS FUMES

IN GARAGE BUILDINGS

INEXPENSIVE SOLUTION TO A SERIOUS GARAGE VENTILATION PROBLEM

For the garage owner planning a new building or extensive remodeling, National has designed and engineered an underfloor system for effective removal of poisonous carbon monoxide gas and smoke. The National Underfloor System is completely fabricated at factory and is shipped complete with motor and blower in a packaged kit—nothing else to buy. A proven, adequate, dependable system—National has many hundreds of installations in garages in every part of the country. Send us a rough drawing of your service area showing position of stalls. We will gladly supply you with plans to suit your needs. Literature on request.

Illustration shows standard kit with four extra tube outlets.

National also makes a complete packaged kit for overhead installation. Literature on request.

Complete Packaged Kit, F.O.B. Decatur,

$319.50

Write for Circular

The National System of Garage Ventilation

Dept. 819-U 330 N. Church Street Decatur, Ill.

World's Largest Manufacturer of Exclusive Garage Ventilating Equipment

The appointments of **Harry E. Seim** as general manager of the **Sturtevant Division** at Hyde Park, Boston, Mass., and **Tom Turner** as general manager of the **Elevator Division** at Jersey City, N. J., have been announced by the **Westinghouse Electric Corp.** Both men will retain their former posts in addition to assuming their new duties. Mr. Seim, vice president and general manager of the Bryant Electric Company, a totally-owned subsidiary of Westinghouse, temporarily will continue to make his headquarters at Bridgeport, Conn., where he has been located for some time. Mr. Turner will have his office in the Elevator Division plant, but he will retain his position as general manager of the Westinghouse Meter Division in Newark, N. J. Mr. Seim and Mr. Turner will replace **Ellis L. Spray,** vice president in charge of the Elevator and Sturtevant Divisions, who is retiring from active service with the Westinghouse because of poor health.

D. J. Erikson, who started his career with **Hagan Corp.,** as a draftsman more than three decades ago, has been elected president of Hagan and its subsidiary companies. He succeeds **J. M. Hopwood,** president of Hagan Corp. since 1918—the only man to pre-date Mr. Erikson in point of service with the company. Mr. Hopwood was elected to the new position of chairman of the board of directors of the Hagan group. Mr. Erikson moved from the drafting board to field service and then into sales work. In 1927 Mr. Erikson was appointed sales manager. On July 1, 1939, Mr. Erikson was elected vice president in charge of sales, Hagan Corporation and subsidiaries.

Duo-Therm Division, Motor Wheel Corp., has announced the appointment of **Louis C. Vandertill** to the position of assistant advertisting manager. In this capacity he will assist Karl Egeler. Mr. Vandertill comes to Duo-Therm from Beurmann-Marshall, Inc., where he was engaged in advertising and sales promotion work. Previous to that he had been an account executive for the Blakslee Advertising Agency.

Formation of the **Hamilton-Thomas Corp.,** Hamilton, Ohio, to operate **Economy Pumps, Inc., Klipfel Manufacturing Co.,** and **Liberty Planers, Inc.,** manufacturing divisions of Hamilton-Thomas, is announced by officers of the newly formed corporation. Officers of the corporation are **Richard Thomas,** president; **L. G. Thomas,** executive vice president; **H. R. Ryan,** vice president; **R. H. Thomas, Jr.,** vice president; **E. T. Drinkuth,** secretary; and **L. V. Thomas,** treasurer.

Lyle A. Christensen, general sales manager of **The Marley Co., Inc.,** manufacturers of water cooling equipment, was recently appointed a vice president of the company. Mr. Christensen has been with the Marley Co. seven years. He was sales engineer in the New York office for five years, moved to the home office in Kansas City in 1946, and became general sales manager in 1947. Before joining the Marley Co., he worked for the Ingersoll-Rand Co. for 12 years. He received his degree in Mining Engineering from the University of Minnesota.

L. A. Christensen

A recent announcement calling attention to **Worthington Pump and Machinery Corp.'s** newly combined Air Conditioning and Refrigeration Distributor Service Department with the Air Conditioning and Refrigeration Sales Division, stated that the new department will be under the direction of **E. C. Hamilton** as manager, with headquarters at Holyoke, Mass. Mr. Hamilton will report to Mr. M. M. Lawler, division manager, with headquarters at Worthington's Harrison works.

E. W. Butzler, a member of the staff of **Hall Laboratories** since their establishment twenty years ago, has been appointed to the new position of business manager of the firm. Mr. Butzler was for many years associated with Dr. R. E. Hall, director of Hall Laboratories, as an engineering consultant on boiler water problems. In 1938 Hall Laboratories' parent firm, Hagan Corporation, assigned him to service as consulting engineer for Hagan and Hall clients in the Pittsburgh area.

R. C. Yantis

Henry Valve Co. of Chicago announces the appointment of **Roy C. Yantis** as general sales manager. Mr. Yantis joined the Henry organization last November as assistant sales manager. Previous to joining the Henry organization he was associated with Frigidaire Corp., Gibson Refrigerator Co., and was chief refrigeration engineer for the Wolverine Tube Division of Detroit.

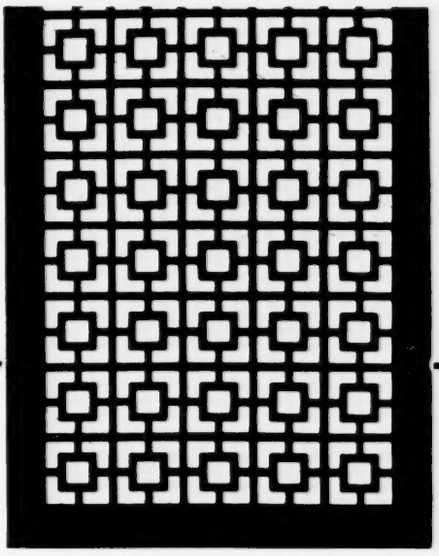
G. C. Goodrich has been appointed sales manager of the General Refrigeration Division, **Yates-American Machine Co.,** Beloit, Wis. He replaced J. E. Edwards. Mr. Goodrich has been with the General Refrigeration Division for a number of years and was assistant to the sales manager prior to his promotion.

Dan Mandery has been named to head the Platecoil Division of the **Kold-Hold Manufacturing Co.,** Lansing, Mich. After nine years in Frigidaire sales and service, Mr. Mandery moved to the Hussman Refrigerator Co. for an eight year span. More recently he has been associated with the Universal Cooler.

The Unit Air Conditioner Division of the **Fedders-Quigan Corp.,** announces the appointment of **J. H. Seippel** as regional manager for the midwest territory, with headquarters at 2715 Sheridan Rd., Evanston, Ill.

The nation's first factory devoted exclusively to mass production of a standard convector-radiator is the new Scranton, Pa. convector-radiator factory of **The Trane Co.,** La Crosse, Wis., manufacturers of heating, cooling and air conditioning equipment. On hand to see the first shipment on its way was Mr. Reuben N. Trane, president of the Company, accompanied by E. A. Cline, manager of the Convector Sales Dept., from La Crosse. Set up to employ 300 at maximum production, the new plant is on an 18-acre plot, which allows ample space for additions. **R. James Trane,** vice president of The Trane Co., and son of the president, is the general manager. **Myles Erickson** is office manager and purchasing agent for the eastern division. **Louis Antol,** formerly an assistant superintendent at Trane's main La Crosse factory, is the superintendent.

W. Vernon Brumbaugh of Chicago, Ill., has been appointed executive secretary of the **Refrigeration Equipment Manufacturers Association.** Mr. Brumbaugh succeeds R. K. Hanson, who has resigned. Mr. Brumbaugh is a veteran in the trade association field, having had 22 years previous experience with national associations representing manufacturers and distributors, including the National Lime Association, Washington, D. C.; The Waxed Paper Institute, Inc., Chicago, Illinois; and American Washer and Ironer Manufacturers' Association, Chicago. Active among trade associations, Mr. Brumbaugh is a member and past president of Washington Trade Association Executives, also a member of the American Trade Association Executives, and the Trade Association Executives Forum of Chicago. Mr. Brumbaugh will be located at the headquarters office of REMA 1107 Clark Building, Pittsburgh, Pa.



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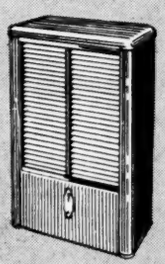

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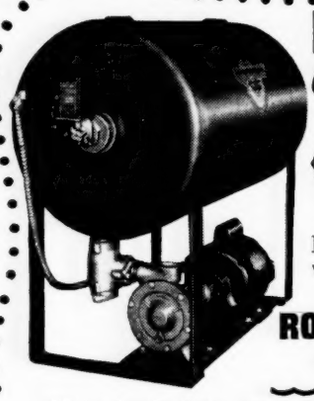

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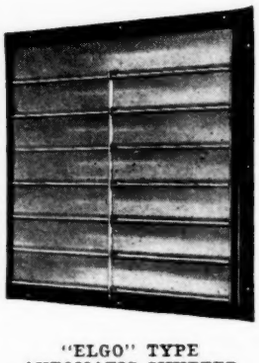

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George R. Prout, vice president of the **General Electric Company** and general manager of the Air Conditioning Department, has been named an assistant general manager of the G-E Nucleonics Department, effective November 1. Mr. Prout will become general manager of the Nucleonics Department on January 1, succeeding Roy C. Muir, G-E vice president who returned from retirement last April to head the department. Mr. Muir will continue as a consultant. **Harold F. Smiddy** will become general manager of the Air Conditioning Department, effective November 1, but will continue in his present post of general manager of the Chemical Department. Mr. Prout's headquarters will be at the Hanford atomic energy works which the company operates for the Atomic Energy Commission near Richland, Wash. Mr. Smiddy will have headquarters both at Bloomfield, N. J., and Pittsfield, Mass. **Robert S. Neblett**, assistant general manager who has been stationed at Hanford, will make his headquarters at Schenectady, where he will be in charge of G-E Nucleonics Department activities in that area.

General Controls Co. has announced the appointment of **B. L. Lerch** as factory branch manager of the new St. Louis office. Mr. Lerch joined General Controls September 1, 1947 as branch manager of the Dallas office. He was formerly with the Mercoid Corporation in Chicago for 10 years. The new St. Louis office will serve the eastern half of Missouri, southern Illinois, southwestern Indiana, western Tennessee, northeastern Arkansas and northern Mississippi. **O. D. Shaddox** was appointed factory branch manager of the new Okhaloma City office. Mr. Shaddox joined General Controls December 1, 1945 as sales engineer at the Kansas City factory branch. The new Oklahoma City office will serve all of Oklahoma and all but the northeastern part of Arkansas.

F. X. Fessler has been named manager of the Dayton district office for **Penn Electric Switch Co.** He succeeds **E. A. Price**, who was made manager of the company's New York district office.

Hagan Corp., combustion and chemical engineering firm, has transferred its San Francisco offices and laboratories to new quarters in the Manufacturers' Agents Exhibit Building, 200 Davis St., San Francisco 11, Calif.

Joseph F. Bourn, architectural engineer of 215 Melba St., Dallas, Texas, has been appointed southwestern sales representative for the home heating equipment division of **Stewart-Warner Corp.**

The Producers' Council announces results of election of officers at the annual meeting held in New York. Officers elected on October 1 are: president, **James M. Ashley**, Libbey-Owens-Ford Glass Co.; first vice president, **C. R. Raquet**, Detroit Steel Products Co.; 2nd vice president, **A. Naughton Lane**, Monarch Metal Weatherstrip Corp.; secretary, **C. A. Snyder**, Richmond Screw Anchor Co., Inc.; treasurer, **W. V. Peters**, Truscon Steel Co.

Establishment of a Pacific Coast Division of **Owens-Corning Fiberglas Corp.** and the appointment of **L. R. Kessler** as its general manager have been announced. Construction of a new Fiberglas plant at Santa Clara, California, is now well under way, and production is scheduled to start there in July 1949. **W. C. Winterhalter** was named sales manager of the new division, reporting to Mr. Kessler. Working under Mr. Winterhalter's supervision are managers of four west coast branch sales offices: **D. R. Dyas**, Los Angeles; **H. B. Little II**, San Francisco; **E. N. Still**, Seattle; and **J. A. Tallman**, Portland. **Walter D. Gipe** will transfer from his post in Toledo as adminstrative assistant to Ben S. Wright, Fiberglas general sales manager, to become service manager of the Pacific Coast Division. The Santa Clara plant will be the fifth U. S. plant operated by Owens-Corning Fiberglas Corp.

Buensod-Stacey, Inc., air conditioning and refrigeration engineering-contractors of New York and Charlotte, N. C., announced that **Martin E. Snyder** has been appointed comptroller. Mr. Snyder formerly was secretary and treasurer of the Carrier Corp. and resigned his position in 1946.

Battelle Institute, Columbus, Ohio, will begin construction of a new half-million-dollar laboratory building late this year. The structure is scheduled for completion in 1949.

Joy **Manufacturing Co.**, Pittsburgh, Pa., recently announced the appointment of **J. Y. Richards** as Chicago district sales manager. Mr. Richards was formerly assistant manager of the Chicago district.

COMING EVENTS

NOVEMBER 19-22, 1948—11th annual convention, Refrigeration Service Engineers Society, Hotel Sherman, Chicago, Ill. Willis Stafford, Chairman, Publicity Committee, 433 N. Waller Ave., Chicago 44, Ill.

NOVEMBER 28-DECEMBER 3, 1948 — Annual meeting, American Society of Mechanical Engineers. Hotels Pennsylvania and New Yorker, New York City. Secretary, C. E. Davies, 29 W. 39th Street, New York, N. Y.

NOVEMBER 29-DECEMBER 4, 1948—18th National Power Show, Grand Central Palace, New York. Charles F. Roth, manager, International Exposition Company, Grand Central Palace, New York, N. Y.

DECEMBER 5-8, 1948 — Annual convention, American Society of Refrigerating Engineers, Hotel Statler, Washington, D. C. Secretary, M. C. Turpin, 40 West 40th St., New York 18, N. Y.

DECEMBER 9-10, 1948—35th annual convention, National Warm Air Heating and Air Conditioning Association, Hotel Cleveland, Cleveland, Ohio. Secretary, George Boeddener, 145 Public Square, Cleveland 14, Ohio.

JANUARY 24-28, 1949—Heating, Ventilating and Air Conditioning Exposition, American Society of Heating and Ventilating Engineers, International Amphitheatre, Chicago, Ill. A. V. Hutchinson, secretary, 51 Madison Ave., New York, N. Y.

JANUARY 25, 1949—Annual convention and membership meeting, National Heating Wholesalers' Association, Blackstone Hotel, Chicago. National Heating Wholesalers Association, 239 Water St., Pittsburgh, Pa.

APRIL 18-20, 1949—1949 Midwest Power Conference, sponsored by Illinois Institute of Technology, at Hotel Sherman, Chicago. Conference director, Roland A. Budenholzer, at Illinois Tech, 3300 So. Federal St., Chicago 16, Ill.

MAY 16-20, 1949—National Oil Heat Exposition, Mechanics Hall, Boston, Mass. Sponsored by Oil-Heat Institute of America, Inc., 6 E. 39th St., New York 16, N. Y.

MAY 24-27, 1949—Annual meeting, National District Heating Association, The New Ocean House, Swampscott, Mass. Secretary, John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh 6, Pa.

NOVEMBER 14-19, 1949—All-Industry Refrigeration and Air Conditioning Exposition, Atlantic City, N. J. Refrigeration Equipment Manufacturers Association, 1107 Clark Bldg., Pittsburgh 22, Pa.

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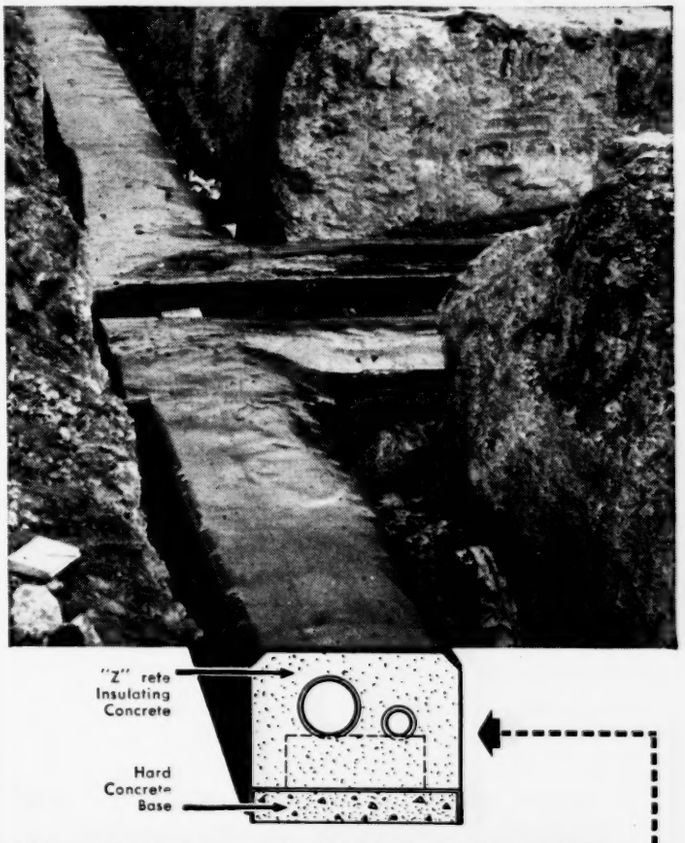

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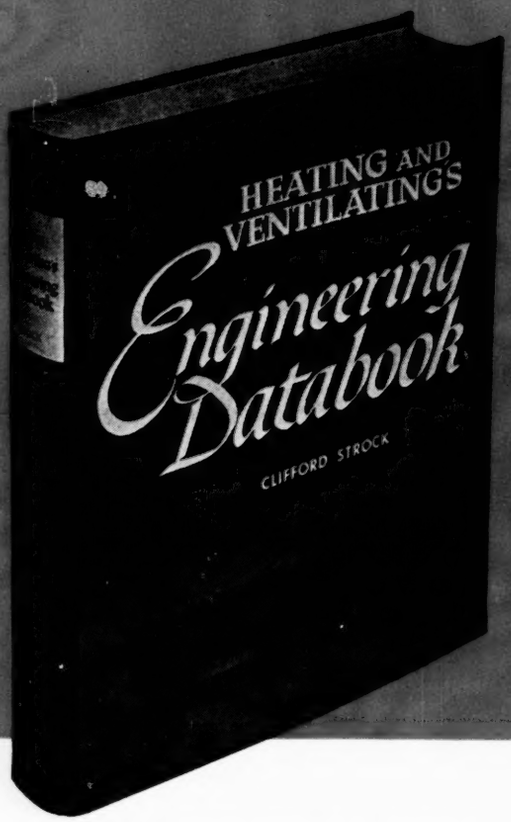

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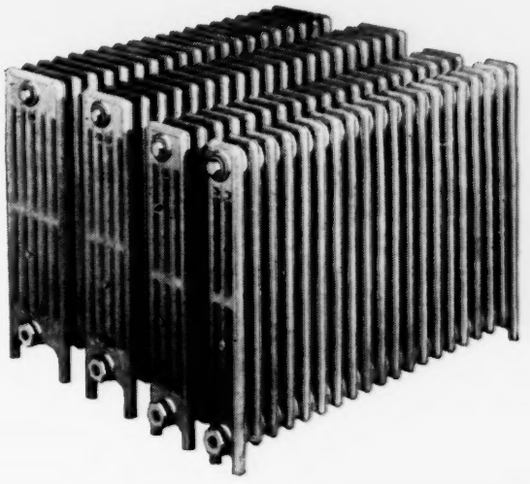

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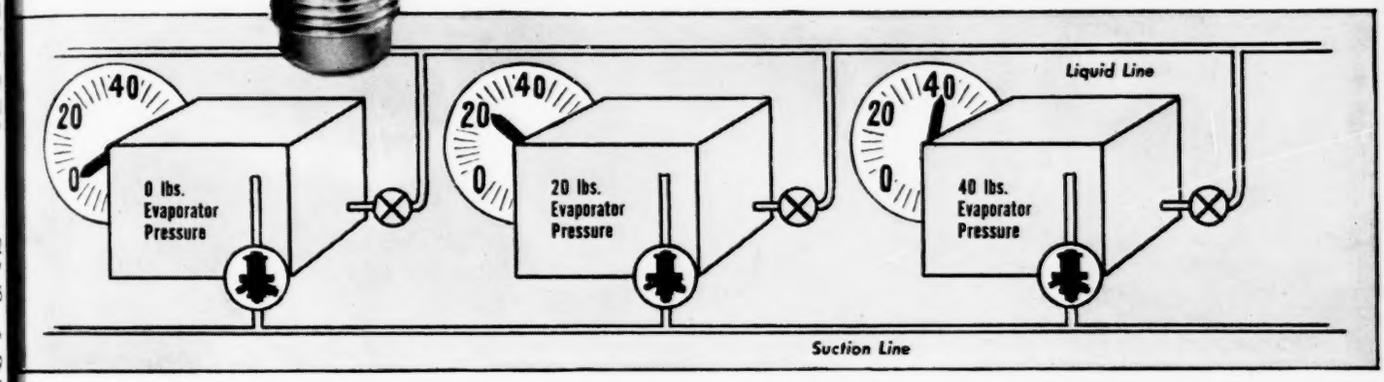

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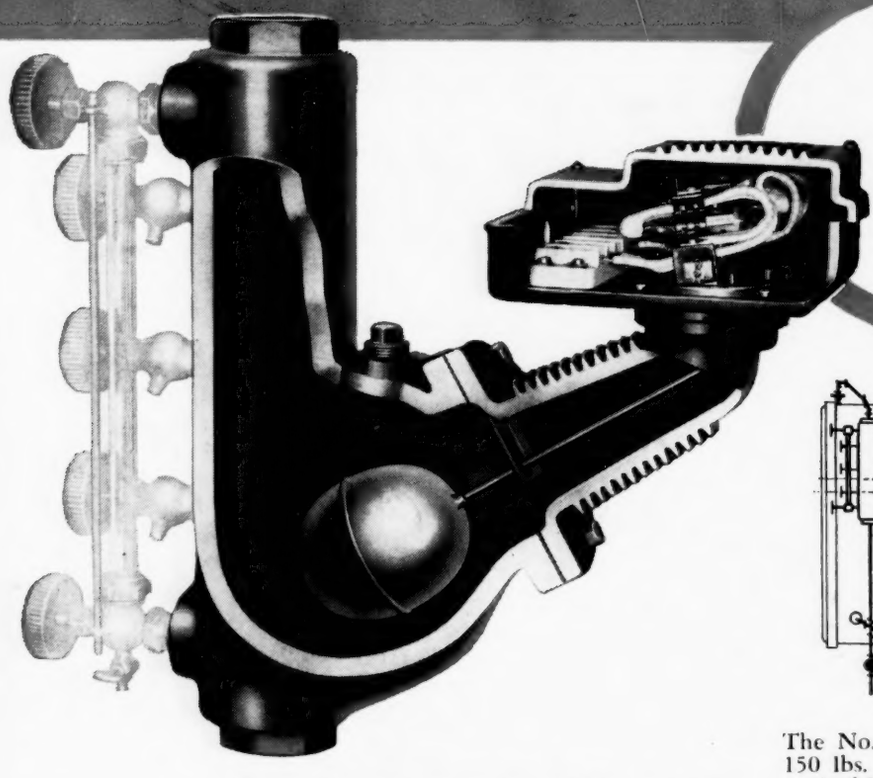
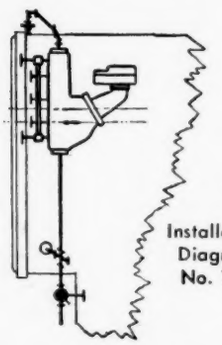
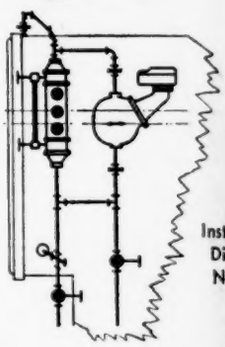
Now comes the NEW McDonnell

No. 157







The No. 157 is for boilers of any size; maximum steam pre
150 lbs. Notice how the operating unit is the same as the w
praised McDonnell No. 150 illustrated at the right above. The i
lation diagrams of the No. 157 and No. 150 immediately above s
through comparison, how practically all equalizing piping an
tings are eliminated by making the No. 157 an integral part o
water column. A worthwhile convenience is found in placin
tappings for water-glass and try cocks in the end of the body s
the control can be located on either side of the boiler. The oper
of the No. 157 is explained below.

. . . . designed to simplify and cut the cost of water level control for high pressure boilers

We call this a new control, but only the method of application is new. As the illustrations show, the No. 157 is actually the dependable and time-tested McDonnell No. 150 low-water cut-off, pump control and low water alarm in water column form. Thus it gives you this modern way of controlling the boiler feed pump and providing emergency low water cut-off and alarm in a form that greatly simplifies installation on boilers having separate water columns.

You simply remove the present water column as shown in the diagram and replace it with the No. 157 unit. The result is a quick, easy, trim, installation giving ideal reproduction of the boiler water level in the float chamber and providing an effective direct blowdown. Still more important in times like these is the elimination of equalizing pipe and fittings. The method saves pipe, fittings and labor. It also provides a better installation under conditions which would require long equalizing piping if the No. 150 were installed.

Here is the easy, economical way to apply the most tested, most modern boiler water level control to boilers of any size, steam pressures up to 150 lbs. Note the diagram opposite explaining the operation of the McDonnell No. 157.

Ask for information and data covering this type of control for any plant conditions.

McDONNELL & MILLER, INC., 1313 Wrigley Bldg., Chicago 11, Ill.

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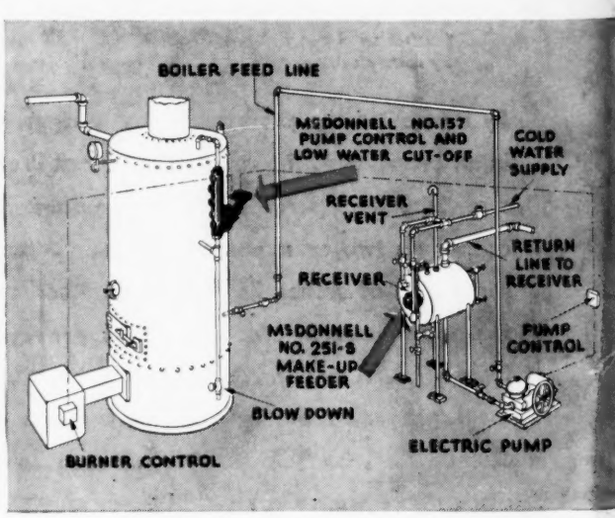
Boiler Water Level Controls



The modern way to control the boiler feed pump <u>from</u> the boiler water level

Boiler feed pump is controlled by the No. 157 from th
boiler water level so that the water line is held withi
close limits which assures maximum steaming efficiency.
McDonnell No. 251-S on the receiver tank assures a suppl
of water in the event of insufficient return of condensat
Extra switch on No. 157 provides circuits for low water fu
cut-off and low water alarm in the event of a current inte
ruption in feed pump circuit. With all conditions provide
for this method means highest efficiency and complete pr
tection from low water. Ask for simple wiring diagram

CHNOLOGY DEPARTMENT

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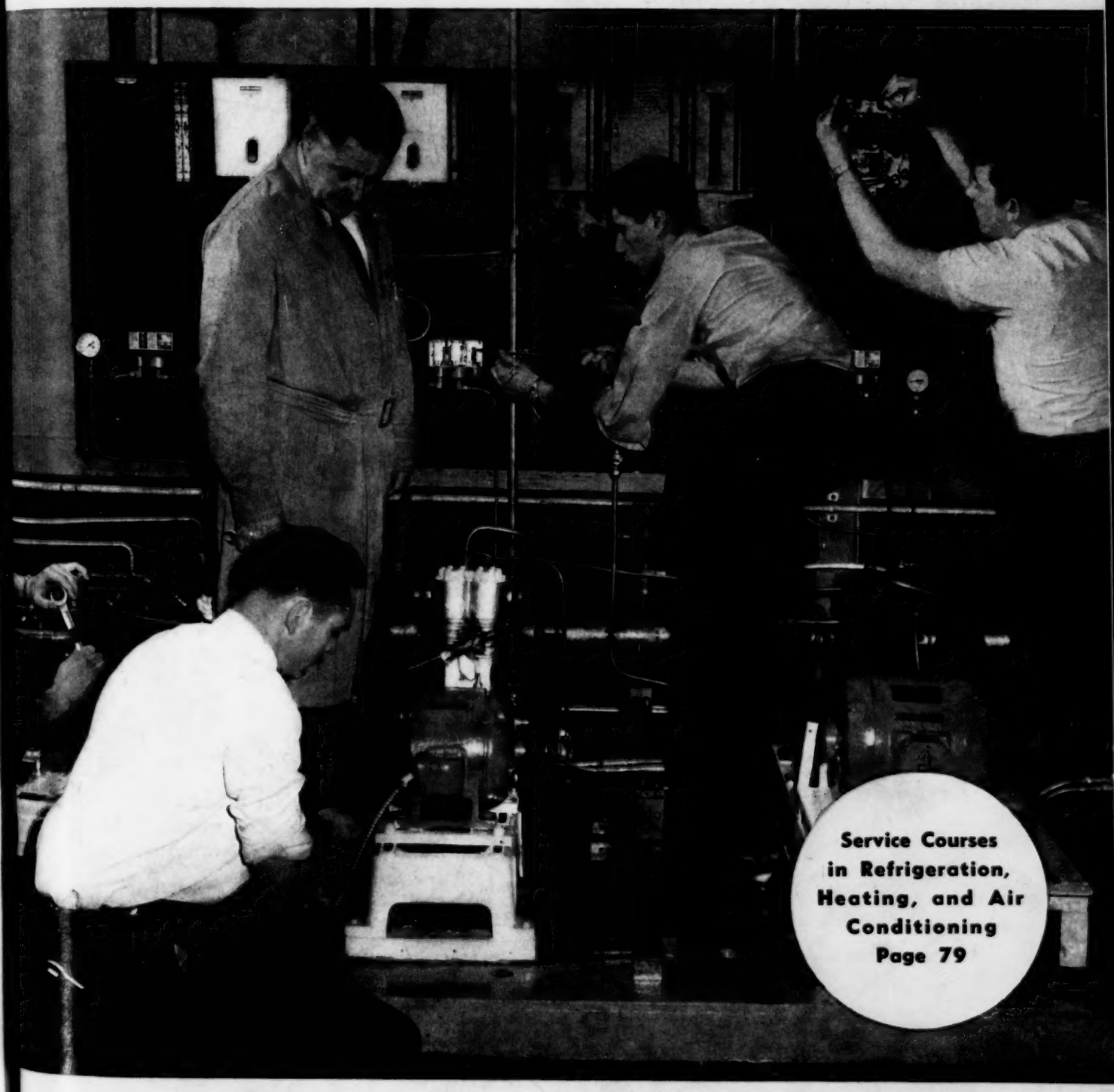

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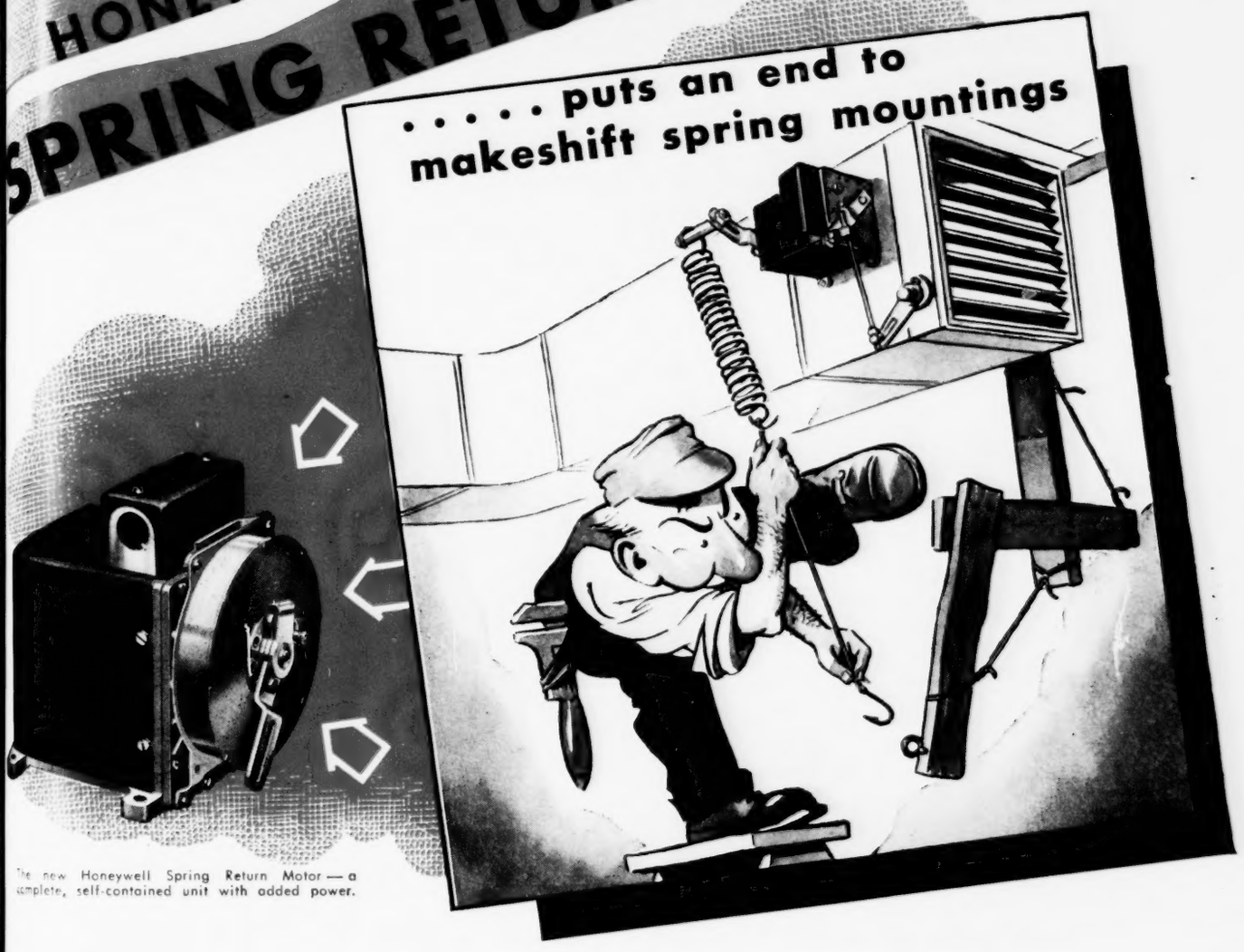
HONEYWELL'S NEW SPRING RETURN MOTOR...



The new Honeywell Spring Return Motor — a complete, self-contained unit with added power.

HERE'S good news! Honeywell has developed a self contained spring return mechanism for its power failure motors. You mount it anywhere—no spring brackets to run up installation costs.

In the event of power failure, this new motor automatically positions the damper either full open or full shut. And with a 160 degree stroke, it offers 2½ times more power than previous models, which were limited to a 60 degree stroke because of the external spring construction. This means only one motor is needed for even larger dampers than before. It also means improved control for unit ventilators where the motor must perform several functions in sequence.

So remember, Honeywell's new spring return motor brings you two important advantages. First, you benefit through simplified installation at lower cost. Secondly, you get more power—2½ times more. And, always, there is positive protection in the event of power failure. Get all the details at once. Just address a card to Minneapolis-Honeywell, Minneapolis 8, Minn. In Canada: Leaside, Toronto 17, Ontario.

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